4-12-2019

PROGRAM and PROCEEDINGS THE NEBRASKA ACADEMY OF SCIENCES: 139th Anniversary Year, One Hundred-Twenty-Ninth Annual Meeting, April 12, 2019, NEBRASKA WESLEYAN UNIVERSITY, LINCOLN, NEBRASKA

Nebrtaska Academy of Sciences

PROGRAM
and
PROCEEDINGS
THE NEBRASKA ACADEMY
OF
SCIENCES

1880-2019

Including the

Nebraska Association of Teachers of Science

(NATS) Division

Nebraska Junior Academy of Sciences

(NJAS) Affiliate

and

Affiliated Societies

139th Anniversary Year

One Hundred-Twenty-Ninth Annual Meeting

April 12, 2019

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 47 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 12, 2019

7:30 a.m.	REGISTRATION OPENS - Lobby of Lecture Wing, Olin Hall
8:00	Aeronautics and Space Science, *Session A* – Acklie 109
	Aeronautics and Space Science, *Session B* – Acklie 111
	Collegiate Academy; Biology, *Session B* - Olin B
	Biological and Medical Sciences, *Session A* - Olin 112
	Biological and Medical Sciences, *Session B* - Smith Callen Conference Center
	Chemistry and Physics; Chemistry - Olin A
8:00	"Teaching and Learning the Dynamics of Cellular Respiration Using Interactive Computer Simulations" Workshop – Olin 110
9:30	"Life After College: Building Your Resume for the Future" Workshop – Acklie 218
8:25	Collegiate Academy; Chemistry and Physics, *Session A* – Acklie 007
8:36	Collegiate Academy; Biology, *Session A* - Olin 111
9:00	Chemistry and Physics; Physics – Acklie 320
9:10	Aeronautics and Space Science, *Poster Session* – Acklie 109 & 111
10:30	Aeronautics and Space Science, *Poster Session* – Acklie 109 & 111
11:00	MAIBEN MEMORIAL LECTURE: *Dr David Swanson* - OLIN B
	Scholarship and Friend of Science Award announcements
12:00 p.m.	LUNCH – WESLEYAN CAFETERIA
	Round-Table Discussion – "Assessing the Academy: Current Issues and Avenues for Growth" led by Todd Young – Sunflower Room
12:50	Anthropology – Acklie 109
1:00	Applied Science and Technology - Olin 111
	Biological and Medical Sciences, *Session C* - Olin 112
	Biological and Medical Sciences, *Session D* - Smith Callen Conference Center
	Chemistry and Physics; Chemistry - Olin A
	Collegiate Academy; Biology, *Session B* - Olin B
	Earth Science – Acklie 007
	Environmental Sciences – Acklie 111
	Teaching of Science and Math – Acklie 218
1:20	Chemistry and Physics; Physics – Acklie 320
4:30	BUSINESS MEETING - OLIN B

NEBRASKA ASSOCIATION OF TEACHERS OF SCIENCE (NATS)

The 2019 Fall Conference of the Nebraska Association of Teachers of Science (NATS) will be held at the Younes Conference Center, Kearney, NE, September 19-21, 2019.
President: Betsy Barent, Norris Public Schools, Firth, NE
President-Elect: Anya Covarrubias, Grand Island Public Schools, Grand Island, 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.nebraskageologicalsociety.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
Acklie Hall Room 109

8:00 1. ENHANCED ULTRASONIC CHARACTERIZATION OF METAL ADDITIVELY MANUFACTURED PARTS USING HYBRID CAPABILITIES. Luz D. Sotelo*, Michael Sealy, Cody Kanger, Rakesh Kumar, Joseph A. Turner, Department of Mechanical and Materials Engineering, University of Nebraska – Lincoln.

8:10 2. VOXEL IMAGE FORMATIONS USING SUPERIMPOSED LASER BEAMS. Auston Viotto, Department of Mechanical & Materials Engineering, University of Nebraska Lincoln.

8:20 3. HIGH EMISSIVITY SURFACES PRODUCED USING FEMTOSECOND LASER SURFACE PROCESSING FOR THERMAL MANAGEMENT OF SATELLITES. Andrew Reicks*, Alfred Tsubaki, Dennis Alexander, and Craig Zuhlke, Department of Electrical and Computer Engineering, Jace Wieseler, Edwin Peng, Mark Anderson, and George Gogos, Department of Mechanical and Materials Engineering, University of Nebraska- Lincoln.

8:30 4. EXPERIMENTAL INVESTIGATION OF TWO-DIMENSIONAL DROP COALESCENCE IN LIQUID-AIR SYSTEMS. Jacob Gottberg*, Haipeng Zhang, and Sangjin Ryu, Department of Mechanical and Materials Engineering, University of Nebraska-Lincoln.

8:40 5. FLUID DYNAMICS OF TWO-DIMENSIONAL LIQUID PINCH-OFF. Stephanie Vavra*, Haipeng Zhang, and Sangjin Ryu, Department of Materials and Mechanical Engineering, Charles Riedesel, Department of Computer Science and Engineering, University of Nebraska-Lincoln.

8:50 6. SPARK PLASMA SINTERING FOR ISRU-ORIENTED LUNAR SIMULANT SOLIDIFICATION. Xiang Zhang and Bai Cui, Department of Mechanical and Materials Engineering, Mahdieh Khedmati and Yong-Rak Kim*, Department of Civil Engineering, University of Nebraska-Lincoln.

9:00 7. CONVERSION OF CALCIUM CARBONATE INTO METHANE AND MULTI-CARBON COMPOUNDS BY A NOVEL MICROBIAL CONSORTIUM. Nicole A. Fiore*, Rebecca V. Kiat, Donald Pan, Caitlin Lahey and Karrie A. Weber, School of Biological Sciences, Nicole R. Buan, Department of Biochemistry, University of Nebraska-Lincoln, Rebecca A. Daly and Kelly C. Wrighton, Department of Crop and Soil Sciences, Colorado State University, Fort Collins.

9:10 BREAK/POSTER PRESENTATIONS – Acklie 109 & 111

9:30 8. RECIPROCAL FOREARM FLEXION-EXTENSION RESISTANCE TRAINING ELICITS COMPARABLE INCREASES IN MUSCLE STRENGTH AND SIZE WITH AND WITHOUT BLOOD FLOW RESTRICTION. Ethan Hill*, Terry Housh, Joshua Keller, Cory Smith, John-Paul Anders, Richard Schmidt, and Glen Johnson, Department of Nutrition and Health Sciences, University of Nebraska Lincoln.

9:40 9. GENE EXPRESSION, BIOMARKER, AND FUNCTIONAL ANALYSIS OF SPACE-FLOWN MICE MUSCLE GROUPS REVEALS ANTIOXIDATIVE ENRICHMENT. Kaitlin Goettsch*, Sean West, and Dhundy (Kiran) Bastola, School of Interdisciplinary Informatics, University of Nebraska at Omaha.

9:50 10. DIRECTING CELLULAR RADIATION RESPONSE VIA FERROPTOSIS MANIPULATION. Joseph Carmicheal*, Alexandra Seas, Nolan File, Chi Lin, Sicong Li, Sukhwinder Kaur, and Surinder K. Batra, Department of Biochemistry and Molecular Biology, University of Nebraska Medical Center, Omaha.

10:00 11. CORTICAL OSCILLATIONS THAT UNDERLIE VISUAL SELECTIVE ATTENTION. Rashelle M. Hoffman*, Christine M. Embury, Brandon J. Lew, Elizabeth Heinrichs-Graham, Tony W. Wilson, and Max J. Kurz, Department of Physical Therapy, Munroe-Meyer Institute, University of Nebraska Medical Center, Omaha.

10:10 12. THE DEVELOPMENT OF A FLUID SHEAR STRESS STREAMER FOR LIVE CELL VIDEO MICROSCOPY. Travis McCumber*, Edson deOliveira, and Dane Wilson, Department of Genetics, Cell Biology and Anatomy, University of Nebraska Medical Center, Omaha.

10:20 13. VISUAL PERTURBATION IMPACTS MUSCLE CO-CONTRACTION WHILE WALKING ON FLAT AND INCLINED TREADMILL. Jie Hao*, Weihua Li, Yuhang Zhang, and Ka-Chun Siu, Department of Physical Therapy Education, University of Nebraska Medical Center, Omaha.

10:30 BREAK/POSTER PRESENTATIONS – Acklie 109 & 111

10:50 14. STRUCTURAL INVESTIGATIONS INTO THE CATALYTIC MECHANISM OF HUMAN MANGANESE SUPEROXIDE DISMUTASE USING NEUTRON AND X-RAY CRYSTALLOGRAPHY. Jahaun Azadmanesh*, William E. Lutz, Kevin L. Weiss, Leighton Coates, and Gloria E. O. Borgstahl, Department of Biochemistry and Molecular Biology, University of Nebraska Medical Center, Omaha.

11:00 15. TESTING QUASAR ACCRETION DISK WIND MODELS USING THE SDSS SPECTRAL DATABASE. Mason Rhodes* and Jack Gabel, Department of Physics, Creighton University, Omaha.

11:10 16. EXPERIMENTAL EVOLUTIONARY INVESTIGATION OF PROTEIN-PROTEIN INTERACTIONS IN LARGE PROTEIN COMPLEXES. Richard Cassidy*, Zoe Alam, Gabby Beeler, and Ann Cavanaugh, Department of Biology, Creighton University, Omaha.

11:20 17. EMISSION SIGNATURE OF BINARY SELF-LENSING SUPERMASSIVE BLACK HOLES. John O. Dancewicz Helmers* and Jack Gabel, Physics Department, Creighton University, Omaha.

11:30 18. SOL-GEL PREPARATION OF NOVEL GEO2 AND GEO2-SIO2 NANOPARTICLES FOR USE IN 3D PRINTED OPTICS. Alexandra Vahle*, Cameron Jayson, and Joel Destino, Department of Chemistry, Creighton University, Omaha.

11:40 19. OPTIMIZED SOL-GEL DERIVED SI-BASED NANOPARTICLES FOR USE IN LUMINESCENCE-BASED CHEMICAL SENSING. Emilia M. Berni*, Peter S. Palencia, and Joel F. Destino, Department of Chemistry, Creighton University, Omaha.

11:50 20. PIPELINE INTO THEORETICAL MATHEMATICS. Griff Elder*, Jacob Cleveland, Xzavier Herbert, Gage Hoefer, Hudson Hooper, Brad Horner, Ethen Kuether, Andrew Li, Sarah McCarty, and Grant Moles, Department of Mathematics, University of Nebraska at Omaha.

AERONAUTICS AND SPACE SCIENCE

Chairperson: Michaela F. Lucas
NASA Nebraska Space Grant & EPSCoR, University of Nebraska at Omaha

SESSION B
Acklie Hall Room 111

8:00 1. COMPUTATIONAL FLUID DYNAMICS ON TRANSITION TO TURBULENCE. Elizabeth Spaulding* and Jae Sung Park, Department of Mechanical and Materials Engineering, Adam Larios, Department of Mathematics, University of Nebraska - Lincoln.

8:10 2. PROTOTYPING AND VALIDATION OF A MODULAR 6-DOF 3-LEG PARALLEL ROBOT ADAPTABLE FROM AN RRRS TO AN RRPS CONFIGURATION. Nathan Jensen* and Carl Nelson, Department of Mechanical and Materials Engineering, University of Nebraska – Lincoln.

8:20 3. DATA ANALYSIS OF TEST ROTORS IN MARTIAN ATMOSPHERIC CONDITIONS. Nathan Jensen, Department of Mechanical and Materials Engineering, University of Nebraska – Lincoln.

8:30 4. EFFICIENT SUPERSONIC ROCKET UTILIZING STUDENT MANUFACTURED CARBON FIBER TUBES. Dillon Margritz*, Quinn Brandt, Bricen Margritz, and Joseph Broadway, Department of Mechanical and Materials Engineering, University of Nebraska-Lincoln.

8:40 5. COMPUTER SCIENCE TRAINING IN HIGHER EDUCATION USING ROBOTICS. William A Loring and Bill Spurgeon*, Information Technology Program, Western Nebraska Community College at Scottsbluff.

8:50 6. NODE BASED PATHFINDING AND SATELLITE AUTONOMOUS NAVIGATION USING THE GO PI GO RASPBERRY PI ROBOT. Daniel Smith* and William Loring, Computer Science, Western Nebraska Community College, Scottsbluff.

9:00 7. ENHANCING INTRODUCTORY CLASSES WITH HANDS ON PROJECTS. Hunter Nelson*, William Spurgeon, and Scott Schaub, Mathematics and Science, Western Nebraska Community College, Scottsbluff.

9:10 BREAK/POSTER PRESENTATIONS – Acklie 109 & 111

9:30 8. COLLEGE OF SAINT MARY SCIENCE ENRICHMENT WORKSHOP SERIES: A FOCUS ON ELEMENTARY SCIENCE EDUCATORS. Amanda Roe*, Department of Biology, Ganesh Naik, Department of Chemistry, Kelly Murphy and Mark Sand, Department of Mathematics 4Math Program, College of Saint Mary, Nancy Thornblad and Dayna Derichs, Omaha Public Schools, Omaha.

9:40 9. IN-VITRO ANTICANCER EFFECT OF CURCUMIN, QUERCETIN AND THEIR COMBINATION ON MELANOMA CELL LINES. Farrah Soll* and Dr. Dunesh Kumari, Department of Chemistry, College of Saint Mary, Tyler Moore, Department of Biology, Bellevue University, Bellevue.

9:50 10. WOMEN IN AVIATION: WHERE ARE THEY? Rebecca Lutte, Aviation Institute, University of Nebraska at Omaha.

10:00 11. HEAVY METAL AND NITRATE CONCENTRATIONS IN GROUND AND SURFACE WATER NEAR CRAWFORD NEBRASKA. Isaac Langan*, Mike Leite, and Jennifer Balmat, Department of Physical Science, Chadron State College, Dr. Dana Richter-Egger, Department of Chemistry, University of Nebraska at Omaha.

10:10 12. IDENTIFYING EARTH ANALOGUE SITES TO TEST AND ASSESS THE MARS HELICOPTER'S ABILITY TO CAPTURE IMAGES OF ASTROBIOLOGICAL TARGETS DURING THE MARS 2020 MISSION. Jessica Rowshandel, Physical and Life Sciences Department, Chadron State College, Chadron.

10:20 13. COMPARISON OF PLANT GROWTH IN THREE MARTIAN SOIL SIMULANTS. Marc Albrecht* and Jackson Barnes, Department of Biology, University of Nebraska at Kearney.

10:30 BREAK/POSTER PRESENTATIONS – Acklie 109 & 111

10:50 14. CORTICAL PROCESSING OF SOMATOSENSORY INFORMATION IS REDUCED WHILE PERFORMING A MOTOR TASK. Michael P. Trevarrow*, James E. Gehringer, Tony W. Wilson, and Max J. Kurz, Department of Physical Therapy and Center for Magnetoencephalography, University of Nebraska at Omaha.

11:00 15. PERCEPTION IN SPACE. Kyle Brozek*, Steven Belcher, Prithviraj Dasgupta, Mukul Mukherjee, Department of Biomechanics, Computer Science Department, University of Nebraska at Omaha.

11:10 16. SUPERVISED AND UNSUPERVISED MACHINE LEARNING TECHNIQUES FOR PREDICTING MOBILITY-RELATED PERCEPTION ERRORS IN ASTRONAUTS. Steven Belcher* and Prithviraj Dasgupta, Computer Science Department, Kyle Brozek and Mukul Mukherjee, Department of Biomechanics, University of Nebraska at Omaha.

11:20 17. BIMANUAL COORDIATION ASSESSMENT USING PROSTHETIC SIMULATORS. Christopher Copeland*, James Pierce, Keaton Young, and Jorge Zuniga, Department of Biomechanics, University of Nebraska at Omaha.

11:30 18. APPLICATIONS OF ANTIMICROBIAL 3D PRINTING MATERIALS IN SPACE. Michael Thompson* and Jorge Zuniga, Department of Biomechanics, University of Nebraska at Omaha.

11:40 19. 3D PROSTHETICS EFFECTS ON STANDING POSTURE IN UNILATERAL UPPER LIMB DEFICIENT CHILDREN. Keaton Young, Department of Biomechanics, University of Nebraska at Omaha, NE 68182.

11:50 20. DEVELOPMENT OF LOW-COST 3D PRINTED ANATOMICAL MODELS FOR PRE-SURGICAL PLANNING AND EDUCATION. David Salazar*, Justin Cramer, Nicholas Markin, Gabe Linke, and Jorge Zuniga, Department of Biomechanics, University of Nebraska Omaha, 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.
Acklie 109 & 111

THE VIRULENCE OF PYTHIUM IRREGULARE AND PYTHIUM ULTIMUM AT VARYING DEGREES OF TEMPERATURE. Alyssa Anderson* and Phyllis Higley, College of Saint Mary, Omaha.

COLLEGE OF SAINT MARY ELEMENTARY OUTREACH PROGRAM 2018-2019. Elisabeth White, Chloe Jensen, and Jennifer Grove*, Department of Biology, College of Saint Mary, Omaha.

EFFECTS OF TEMPERATURE AND PLANT HOST ON THE VIRULENCE OF ISOLATES OF PYTHIUM IRREGULAR AND PYTHIUM ULTIMUM. Emma Turner* and Phyllis Higley, Department of Biology, College of Saint Mary, Omaha.

AMORPHOUS FORMULATION OF POORLY SOLUBLE CURCUMIN AND PIPERINE: CHARACTERIZATION AND *IN VITRO* STUDIES. Anne Wilson* and Dunesh Kumari, Department of Chemistry, College of Saint Mary, Deepal Vora, School of Pharmacy, Creighton University, Omaha.

DEVELOPMENT OF CHEMICALLY MODIFIED LUMINESCENT SILICON NANOSTRUCTURES WITH POTENTIAL USE IN THE DETECTION OF ABIOGENIC COMPOUNDS. Peter S. Palencia, Emilia M. Berni, and Joel F. Destino*, Department of Chemistry, Creighton University, Omaha.

USING DRONE IMAGERY TO EVALUATE LANDSCAPE-BASED VARIATION IN VEGETATION OF THE NEBRASKA SANDHILLS. Alexander Larsen and Mary Ann Vinton*, Environmental Science Program and Department of Biology, Creighton University, Omaha.

ENVIRONMENTAL MONITORING THROUGH NATIVE PRAIRIE RESTORATION. Anthony Warrior*, Lorraine Smith*, Alexander White, Gabriela Medina, Inessa Lyons, Susan Morris, Clorice Denny, Marcus Redwing, and Hank Miller, Department of Natural Resources, Nebraska Indian Community College, Niobrara.

DEVELOPMENT OF A DEPLOYABLE AND RETRACTABLE BOOM FOR SPACE PLATFORMS. Renick Wilson*, Ryan Green, Tom Faulconer, and Zoe Marzouk, College of Engineering, Mechanical and Materials Engineering, University of Nebraska-Lincoln.

ASSESSMENT OF 3D PRINTED FINGER PROSTHESES: A COMPARATIVE CASE STUDY. Claudia Cortes Reyes*, Roberto Saavedra, Keaton Young & Jorge Zuniga, Department of Biomechanics, University of Nebraska at Omaha.

EFFICACY OF ASSISTIVE DEVICES PRODUCED WITH ADDITIVE MANUFACTURING. James Pierce*, Christopher Copeland, and Jorge Zuniga, Department of Biomechanics, Will Picken, Department of Electrical Engineering, University of Nebraska at Omaha, Omaha NE 68182, Jean Peck, CHI Health, Omaha.

IMPLEMENTATION OF A 3D SCANNER ARM. Walker Arce*, James Pierce III, and Jorge Zuniga, Department of Biomechanics, University of Nebraska at Omaha.

WALKING ON INCLINED SURFACE ENHANCES OBSTACLE NEGOTIATION CAPABILITY FOR ASTRONAUTS. Devan Sedlacek, Weihua Li*, Jiani Lu, and Jung Hung Chien, Department of Physical Therapy Education, University of Nebraska Medical Center, Omaha.

IMPACT OF GENDER CHARACTERISTICS, EMPATHY, AND STRESS ON TASK PERFORMANCE RELEVANT TO NASA MISSIONS. Abi M Heller* & Janelle N Beadle, Department of Gerontology, University of Nebraska Omaha.

HD-TDCS DIFFERENTIATES FRONTO-VISUAL THETA LATERALIZATION DURING VISUAL SELECTIVE ATTENTION. Rachel K. Spooner*, Michael Rezich, and Tony W. Wilson, Department of Neurological Sciences, Center for Magnetoencephalography, University of Nebraska Medical Center, Omaha.

ANTHROPOLOGY

Co-chairs: Wayne Babchuk and Emily Jensen
Department of Anthropology, University of Nebraska–Lincoln
Acklie Hall Room 109

12:50 WELCOME AND INTRODUCTION. Emily Jensen and Wayne Babchuk, Co-Chairs, Anthropology Section, Nebraska Academy of Sciences.

1:00 1. VERBAL AND NONVERBAL CHANNELS OF COMMUNICATION AFTER COMPLETING TASKS VARYING ON TASK DIFFICULTY. Philip Lai*, Rachel Southard, Breana Johnson, and Elaina Eddy, University of Nebraska-Kearney

1:10 2. USING VIRTUAL REALITY AND DIGITAL ARTIFACTS TO ENHANCE DATABASE STRUCTURES AND FACILITATE DATA REUSE. Cole Juckette, Department of Anthropology, University of Nebraska-Lincoln

1:30 3. SYNCRETIC ARTWORK OF THE CHILAM BALAM. Amy Sue Peterson, Department of Anthropology, University of Nebraska-Lincoln

1:50 4. LOW-POWER USE-WEAR ANALYSIS OF OBSIDIAN ARTIFACTS FROM THE EL INGA/SAN JOSE SITES, ECUADOR. Paige Herrera, Department of Anthropology, University of Nebraska-Lincoln

2:10 5. CERAMIC AND OSL ANALYSIS AT 25HO21. Ryan Mathison, Department of Anthropology, University of Nebraska-Lincoln.

2:30 6. COMPARING PRIMATE DENTAL DEVELOPMENT AMONG *GORILLA GORILLA* AND *GORILLA BERINGEI* SPECIES. Rachel Dickerson and Emily Hammerl, Department of Anthropology, University of Nebraska-Lincoln

2:50 BREAK

3:00 7. OSTEOLOGICAL PATHOLOGY IN HUNTER-GATHERER POPULATIONS. Bailey Ottel, Department of Anthropology, University of Nebraska-Lincoln

3:20 8. "VISCERAL CARTOGRAPHIES" OF AZERBAIJAN AS STANDARD STORIES OF VICTIMHOOD: USING SITUATIONAL ANALYSIS IN GEOPOLITICAL RESEARCH. James Baker, Department of Geography, University of Nebraska-Lincoln

3:40 9. THE ARABIAN BEDOUIN: AN IMPOVERISHED NOBILITY. Sarah Ghannam Department of Anthropology, University of Nebraska-Lincoln

4:00 10. EXPLORING ETHNOGRAPHIC METHODS IN NONTRADITIONAL CONTEXTS: A STUDY OF PUBLIC LIBRARIES AND LITERACY ACHIEVEMENT. Tiffany Young, Department of Teaching, Learning, and Teacher Education, University of Nebraska-Lincoln

4:20 11. THEY WALKED WITH THE BUFFALO: A RESPONSE TO ANGLO-AMERICAN PERCEPTIONS OF MANDAN WOMEN. Jayne Kinney, Department of History, University of Nebraska-Lincoln

4:40 12. DEVELOPING AN AUGMENTED REALITY TOUR OF CAMPUS HISTORY USING GEOGRAPHIC INFORMATION SYSTEMS AND 3D MODELING. Jancy Nielson, Heather Richards-Rissetto, and Effie Athanassopoulos, Departments of Anthropology and Classics, University of Nebraska-Lincoln

5:00 ADJOURN

APPLIED SCIENCE AND TECHNOLOGY

Chairperson: Mary Ettel
Wayne State College, Wayne
Olin Hall Room 111

1:00 OPENING REMARKS

1:05 1. DETECTION OF CANNABINOIDS FROM MARIJAUNA FLOWER, CONCENTRATE AND TOPICAL USING COLORIMETRIC SENSOR ARRAYS. Andres V. Mora*, Michael Kangas and Andrea E. Holmes, Department of Chemistry, Doane University, Crete, NE; and Amanda DeBono, AgriScience Labs, Denver, CO

1:20 2. IMPROVING ASSESSMENT METHODS OF TARTARIC ACID IN WINE. Jasmine DeMonte* and Darius Agoumba, Department of Physical Sciences and Mathematics, Wayne State College, Wayne, NE

1:40 3. DEVELOPMENT OF A MANUFACTURING METHOD FOR SUPER COILED POLYMER ACTUATORS. Caleb Gilmore*, Renick Wilson, Brandon Warren, Kevin Dejonge, Lindsay Barnum and Han Jiang, Department of Mechanical Engineering, University of Nebraska-Lincoln, Lincoln, NE

1:55 4. MARS 2020 HELICOPTER: ENHANCING MISSION AND TECHNOLOGY OBJECTIVES THROUGH SIMULATION. Chance Adolf, Department of Physical and Life Sciences, Chadron State University, Chadron, NE

2:15 BREAK

2:20 5. “SMART” NEST BOX TECHNOLOGY: UTILIZING UNIQUE ADVANTAGES WITHIN COMMUNITY COLLEGES TO EXPEDIENTLY AND REMOTELY COLLECT AVIAN DATA. Dylan Smith*, Michael Bates, Landon Sokol, Tychique Kutalu, Elizabeth Ewing, Janessa Grooms, Andres Espino, Alejandro Espino, Alex Koch, Kayla Kreizel, Steven Heinisch, and Lauren Gillespie*, Department of Academic Education, Central Community College, Columbus, NE; and Neil Grandgenett, Department of STEM Education, University of Nebraska-Omaha, Omaha, NE

2:40 6. A FORMAL APPROACH TO CIRCLE FORMATION IN MULTI-AGENT SYSTEMS. Rui Yang*, Azad Azadmanesh and Hassan Farhat, Department of Computer Science, University of Nebraska-Omaha, Omaha, NE

2:55 7. PERFORMANCE COMPARISON OF SDN CONTROLLERS USING DIFFERENT NETWORK ENVIRONMENTS. Shideh Yavary Mehr* and Byrav Ramurthy, Department of Computer Science and Engineering, University of Nebraska-Lincoln, Lincoln, NE

BIOLOGICAL AND MEDICAL SCIENCES

Chairperson: Annemarie Shibata
Department of Biology, Creighton University

SESSION A

Session Chairperson: Annemarie Shibata, Creighton University
Olin Hall Room 112

8:00 1. USING WEARABLE ROBOTICS TO REVEAL THE TIME PROFILE OF METABOLIC COST. Philippe Malcolm*, Prokopios Antonellis, Arash M. Gonabadi, University of Nebraska Omaha, Omaha, NE 68182

8:10 2. ANTIMICROBIAL PROPERTIES OF ETHER-CONTAINING 1,3,4-TRISUBSTITUTED-1,2,3-TRIAZOLIUM SALTS. Eilidh I Chowanec* and James T Fletcher, Department of Chemistry, Creighton University, Omaha, NE 68178

8:20 3. FLEXIBLY SWITCHING POSTURAL RESPONSES BETWEEN STRUCTURED VISUAL STIMULI DEPENDS ON THE TEMPORAL DETERMINISM OF THE STIMULI. Zachary Motz*, Takashi Sado, William Denton, Mukul Mukherjee, Department of Biomechanics, University of Nebraska at Omaha, NE 68182

8:30 4. INSECT VISITORS TO PRAIRIE FLOWERS: PROPORTIONS OF DIFFERENT GROUPS. Sydney E. Westphal* and Theodore Burk, Central High School, Omaha, NE, 68102, and Biology Department, Creighton University, Omaha, NE 68178

8:40 5. BIODIVERSITY OF VECTOR MOSQUITOES AT THE US MEAT ANIMAL RESEARCH CENTER. Justine Amalia LaViolette*, Troy Anderson, Bellevue University, Bellevue, NE 68005

8:50 6. CONSISTENT SIMILARITY IN NEST DEFENSE BEHAVIOR BETWEEN EASTERN BLUEBIRD MATED PAIRS WITH BOTH UV AND MELANIN ORNAMENTS SIGNALING BEHAVIOR. Elizabeth Ewing, Kayla Kreizel, Andres Espino, Jenessa Grooms, Alex Koch, Steve Heinisch, Lauren Gillespie*, Department of Academic Education, Central Community College, Columbus, NE, 68601

9:00 7. THE USE OF BACTERIOPHAGE COCKTAILS TO DECONTAMINATE POLLUTED WATER, SURFACES, AND FOODSTUFFS. Natalie Kuhn* and Michael Olive, Department of Biology, Nebraska Wesleyan University, Lincoln, NE 68504

9:10 8. THE EFFECT OF NORA VIRUS INFECTION ON NATIVE GUT BACTERIAL COMMUNITIES AND LIFESPAN OF *DROSOPHILA MELANOGASTER*. Makayla Nemecek*, Rebecca Best, Shelby Liesemeyer, Darby J Carlson, Julie J Shaffer, and Kimberly A Carlson, Department of Biology, University of Nebraska at Kearney, Kearney, NE 68849

9:20 BREAK

9:30 9. ASSESSING THE EFFECTIVENESS OF A NOVEL DNA VACCINE AGAINST *TOXOPLASMA GONDII.* Rosalie Warner, University of Nebraska-Omaha, Omaha, NE 68182

9:40 10. CHARACTERIZATION OF *STAPHYLOCOCCUS LUGDUNENSIS* BIOFILMS. Justine M. Pitzer* and Austin S. Nuxoll, Department of Biology, University of Nebraska at Kearney, Kearney, NE 68849

9:50 11. PHOSPHINATE-CONTAINING FLUOROPHORES AS GATED SMALL MOLECULE DELIVERY PLATFORMS. Lauren Lesiak*, Yuan Fang, Mehrdad Shadmehr, Xinqi Zhou, Cliff Stains, University of Nebraska-Lincoln, Lincoln, NE 68588

10:00 12. PEPPERMINT ESSENTIAL OIL (*MENTHA PIPERITA*) AS A NATURAL REPELLENT AGAINST AMERICAN COCKROACHES (*PERIPLANETA AMERICANA*). Breana Dobesh* and Marc Albrecht, Department of Biology, University of Nebraska at Kearney, Kearney, NE 68849

10:10 13. CHARACTERIZATION OF THE INTERACTION BETWEEN CAF-1 AND PCNA. Jacquelyn Wright, Department of Chemistry, Creighton University, Omaha, NE 68178

10:20 14. ACQUISITION RATE OF THE GUT MICROBIOTA IN *DAPHNIA MAGNA*. Jessica Hotovy*, Sarah Tjards, Reilly Cooper, Dr. Clayton Cressler, Department of Biological Sciences, University of Nebraska Lincoln, NE 68508

10:30 15. CHARACTERIZATION OF TARDIGRADE MICROBIOME. Mary Morris* and Jenifer Grove, Department of Biology, College of Saint Mary, NE 68106

10:40 16. EXAMINATION OF DRONE (UAS) USE FOR SPOTTING CANADA GEESE ON A CENTRAL NEBRASKA LAKE. Riley Pulver* and Marc Albrecht, Department of Biology, University of Nebraska-Kearney, Kearney, NE 68849

11:00 MAIBEN MEMORIAL LECTURE - OLIN HALL B

SESSION B

Session Chairperson: Marsha Pierce, Creighton University
Smith Callen Conference Center

8:00 1. GROWTH KINETICS OF A SUSPENDED CELL ARTHROBACTER AURESCENS TC1 SYSTEM GROWN IN GLUCOSE + ATRAZINE MINIMAL MEDIA. Teryn Koch[1]*, James Reddick[1], and Christopher D. Wentworth[2], Doane University, Crete, NE 68333, [1]Department of Biology, [2]Department of Physics & Engineering, Doane University, Crete, NE 68333

8:10 2. DECREASED TRICARBOXYLIC ACID (TCA) CYCLE ACTIVITY IN *STAPHYLOCOCCUS AUREUS* INCREASES SURVIVAL TO INNATE IMMUNITY. Trevor Daubert*, Kennedy Kluthe*, Alexis Page, Daniel Nabb, and Austin Nuxoll. Department of Biology, University of Nebraska at Kearney, NE 68849

8:20 3. IDENTIFICATION AND VALIDATION OF FBXO9 INTERACTING PROTEINS IN ACUTE MYELOID LEUKEMIA. Mika Caplan*, R. Willow Hynes-Smith, Samantha Swenson, Karli Wittorf, Heather Vahle, Tyler Gilbreath, and Shannon Buckley, Dept. of Genetics, Cell Biology, and Anatomy, University of Nebraska Medical Center, Omaha, NE 68198

8:30 4. PROBING ASTROCYTE FUNCTION IN FRAGILE X SYNDROME USING HUMAN PLURIPOTENET STEM CELL-DERIVED ASTROCYTES. B. Ren, P. Ragunathan, Y. Jung, V. Sani, B. Oldham*, A. Armstrong, N. Raj, G. Bassell, A. Dunaevsky, Developmental Neurosci., Univ. of Nebraska Med. Ctr., Omaha, NE, Dept. of Cell Biol., Emory Univ. Sch. of Med., Atlanta, GA

8:40 5. PERSISTER FORMATION IN *STAPHYLOCOCCUS EPIDERMIDIS* CLINICAL ISOLATES. Seth Ostdiek*, Amber Menard, Kaitlyn Pineda, and Austin Nuxoll, Department of Biology, University of Nebraska at Kearney, Kearney, NE 68849

8:50 6. FDA-APPROVED DRUGS ADMINISTERED IN COMBINATION AS TREATMENT AGAINST CHRONIC *TOXOPLASMA GONDII* INFECTION. Maxwell Virus, University of Nebraska-Omaha, Omaha, NE 68182

9:00 7. ELUCIDATION OF THE NOVEL ANTIPARASITIC TARGET ROP1 FROM AN INTEGRATED FORWARD GENETIC SCREEN IN *TOXOPLASMA GONDII.* Matthew C. Martens*, Madalyn M. McFarland, Abigail K. Judge, Thomas T. Schulze, Harim I. Won, Paul H. Davis, Department of Pathology and Microbiology, University of Nebraska Medical Center, Omaha, NE 68198

9:10 8. ANTIBACTERIAL EFFECTS OF ESSENTIAL OILS ON A BACTERIAL STRAIN ISOLATED FROM A PATIENT WITH STASIS DERMATITIS. Jamie Stewart, Bryan College of Health Sciences, Lincoln, NE 68506

9:20 BREAK

9:30 9. EXPRESSION OF VIR-1 AND VAGO IN NORA VIRUS *INFECTED DROSOPHILA MELANOGASTER* HEMOLYMPH. Amanda Macke*, Darby J Carlson, and Kimberly A. Carlson, Department of Biology, University of Nebraska at Kearney, Kearney, NE 68849

9:40 10. THE ROLE OF THE OAZ1 RNA IN CONTROLLING GENE EXPRESSION. Logan P. Baumberger*, Taylor L. Burke, Garrett A. Soukup, and Juliane K. Soukup, Department of Chemistry, Creighton University, 2500 California Plaza, Omaha, NE 68178, & Creighton University School of Medicine, 2500 California Plaza, Omaha, NE 68178.

9:50 11. STRUCTURAL ANALYSIS OF OAZ1 RNA IN CRASSOSTREA GIGAS. Spencer Thompson*, Siddharth Venkatraman, Juliane Soukup, Department of Chemistry, Creighton University, 2500 California Plaza, Omaha, NE 68178

10:00 12. A SCREEN OF CHROMATIN ARCHITECTURAL PROTEINS WITH HISTONE MODIFICATION PARTNERS FOR INSULATOR ACTIVITY IN *SACCHAROMYCES CEREVISIAE*. Nicholas Scalora*, Joe Larkin*, Keegan Whisler*, Aubrey Schatz, and Brett J. Schofield, Department of Biology, Doane University, Crete, NE 68333

10:10 13. ACTIVATION OF IMMUNE CELLS AS THE MECHANISM OF ACTION OF ANTISCHISTOSOMAL COMPOUND SAS1. Samantha Sack*, Caelyn Armshaw, and Paul Davis, Department of Biology, University of Nebraska at Omaha, NE 68182

10:20 14. DETERMINATION FOR ENHANCED YIELDS OF *PSEUDOMONAS AERUGINOSA* PERSISTER CELL POPULATION AFTER THE TREATMENT OF VARYING ANTIBIOTICS. Courtney Marcelino*, Dr. Arin Sutlief, and Marco Perez, Doane University, Crete, NE 68333

10:30 15. CLONING, EXPRESSION, AND CHARACTERIZATION OF 5-AMINOLEVULINIC ACID DEHYDRATASE FROM *ESCHERICHIA COLI.* Frank A. Kovacs*, Michael A. Moxley, and Samuel Novicki, Department of Chemistry, University of Nebraska at Kearney, NE 68849

10:40 16. CHANGING ANKLE STIFFNESS TO ADAPT TO DIFFERENT MECHANICAL DEMANDS. Erica A. Hedrick[1]*, Philippe Malcolm[1], Jason M. Wilken[2], Kota Z. Takahashi[1], [1]Department of Biomechanics, University of Nebraska at Omaha, Omaha, NE 68182, [2]Department of Physical Therapy & Rehabilitation Science, University of Iowa, Iowa City, Iowa 52242

11:00 MAIBEN MEMORIAL LECTURE - OLIN HALL B

SESSION C

Session Chairperson: Patricia Soto, Creighton University
Olin Hall Room 112

1:00 1. DRIVING FORCES STABILIZING CELLULAR PRION PROTEIN (PRPC) MONOMERS AND DIMERS ON THE CELL SURFACE. Frances Morden*, Patricia Soto, Creighton Univ, Omaha, NE 68178

1:10 2. POLYMORPHISMS MODULATE SHEEP PRION PROTEIN SUSCEPTIBILITY TO MISFOLDING BY ALTERING THE LOCAL RESIDUE NETWORK OF INTERACTIONS. India Claflin*, Alyssa Bursott, Noah Yoshida, Patricia Soto. Creighton Univ, Omaha, NE 68178

1:20 3. INVESTIGATING THE STRUCTURAL EFFECTS OF POINT MUTATIONS ON ACETYLTRANSFERASES BY COMPUTATIONAL METHODS. Kole J. Runyan[1]*, Sara Lowe[2], Logan Kaler[2], Patricia Soto[3], Yadilette Rivera-Colón[2], [1]Department of Chemistry, Creighton University, [2]Bay Path University, [3]Department of Physics, Creighton University, Omaha, NE 68178

1:30 4. OPTIMIZATION: UTILIZING SIRNAS TO KNOCKDOWN ARGONAUTE GENE FAMILY AND DETECTION OF BOVINE MIRNAS. 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

1:40 5. ADIPOSE TISSUE RENIN-ANGIOTENSIN SYSTEM AND SYSTEMIC HYPERTENSION. Steven D. Scott*, Elizabeth J. Pekas, Ronald J. Headid III, Michael D. Shukis, and Song-Young Park, School of Health and Kinesiology, University of Nebraska at Omaha, Omaha, NE 68182

1:50 6. EFFICACY OF PAN-PARASITIC EXPERIMENTAL COMPOUNDS AGAINST *TOXOPLASMA GONDII* IN BOTH *IN VITRO* AND *IN VIVO* MODELS. Austin Sanford*, Ryan Grove, Alexander Wallick, Rosalie Warner, Gabrielle Watson, Xiaofang Wang, Jonathan L. Vennerstrom, and Paul H. Davis, University of Nebraska Medical Center, Omaha, NE 68198

2:00 7. CHARACTERIZATION OF SHEEP IFITM3 AS A RESTRICTION FACTOR OF SMALL RUMINANT LENTIVIRUS. Marisa Foster*, Jason Iltz, Dane Bowder, Department of Biology, Doane University, Crete, NE 68333

2:10 8. POSSIBLE PATHOGENIC EFFECT CAUSED BY NORA VIRUS INFECTION IN *DROSOPHILA MELANOGASTER*. Lesley Towery*, Amanda McCown, Abigail Benz, Devyn Crisman, and Kimberly A. Carlson, Department of Biology, University of Nebraska at Kearney, Kearney, NE 68849

2:20 9. EFFECTS OF CURCUMIN ON THE NF-κB PATHWAY IN TRIPLE NEGATIVE BREAST CANCER. Gabrielle Brumfield*, Shoichi Arai, and Ann Buchmann, Department of Mathematical and Natural Sciences, Chadron State College, Chadron NE 69337

2:30 10. HIGH GLUCOSE CONDITIONS AFFECT PHYSICAL CHARACTERISTICS OF BREAST CANCER CELLS AND INCREASES PROLIFERATION THROUGH POLYAMINE PATHWAY. Jose Ortega, Caleb Capellen, Roman W Schmidt, Diganta Dutta, and Surabhi Chandra, University of Nebraska-Kearney, Kearney, NE 68849

2:40 BREAK

2:50 11. PLATELET MEDIATED RESCUE OF PANCREATIC CANCER CELLS IN ANCHORAGE- INDEPENDENT CONDITIONS. Gabrielle Brumfield[1]*, Andrew Cannon[2], Sushil Kumar[2], and Surinder K. Batra[2],[3], [1]Department of Mathematical and Natural Sciences, Chadron State College, Chadron, NE, [2]Department of Biochemistry and Molecular Biology, [3]Fred and Pamela Buffet Center, University of Nebraska Medical Center, Omaha, NE 68198

3:00 12. IDENTIFYING THE MOLECULAR TARGET OF ANTITOXOPLASMA COMPOUND SW33. Sean Watson*, Andrew Pham, Austin Sanford, and Paul Davis, University of Nebraska at Omaha, Omaha, NE 68182

3:10 13. DYSBINDIN AND AMYLOID PRECURSOR PROTEIN INVOLVEMENT IN NEURAL DEVELOPMENT AND BEHAVIOR IN *DROSOPHILA MELANOGASTER*. Wacey Gallegos* & Ann Buchmann, Department of Mathematics and Natural Sciences, Chadron State College, Chadron, NE 69337

3:20 14. EXAMINATION OF ORNITHINE DECARBOXYLASE ANTIZYME RNA STRUCTURE AND FUNCTION FOR THE DEVELOPMENT OF ANTIBIOLOGICAL AGENTS. Zach Frevert*, Korey Krutsinger, and Julie Soukup, Department of Chemistry, Creighton University, Omaha, NE 68178

3:30 15. DEFINING THE BIOLOGICAL ROLE OF THE CONNEXIN43 CARBOXYL TERMINAL ALPHA HELICAL DOMAINS. Andrew Pham*, Gaelle Spagnol, Andrew Trease, Li Zheng, and Paul Sorgen, Department of Biochemistry and Molecular Biology, University of Nebraska Medical Center, NE 68198

3:40 16. CHICKEN HATCHLINGS AS AN ALTERNATIVE HOST FOR BUGGY CREEK VIRUS. Alison Guyer*, Tyler Rollman, and Carol Fassbinder-Orth, Department of Biology, Creighton University, NE 68178

3:50 17. SECONDARY STRUCTURE ANALYSIS WITH SHAPE-MAP OF HUMAN HERPESVIRUS 8 POLYADENYLATED RNA. Tim Reznicek, University of Nebraska-Omaha, Omaha, NE 68182

4:00 18. A SEMI-AUTOMATED SYSTEM FOR QUANTIFYING FOOT TEMPERATURE CHANGES FOLLOWING LOCOMOTION. Andrew M. Kern*[1], Gregory J. Faber[1], Jacob Bloomberg[2] and Kota Z. Takahashi[1], [1]Department of Biomechanics, University of Nebraska at Omaha, NE 68122, [2]Neuroscience Laboratories, NASA-Johnson Space Center, TX 77058

4:10 19. THE ORAL MICROBIOME IN FELINE STOMATITIS. Sarah Schiefelbein, Bellevue University, Omaha, NE 68005

4:20 20. MAPPING THE BINDING SITES FOR CAF-1 ON PCNA. Robyn Scott* and Dr. Lynne Dieckman, Chemistry Department, Creighton University, Omaha, NE 68178

4:30 21. DEVELOPMENT AND CHARACTERIZATION OF A POLYMERASE CHAIN REACTION ASSAY FOR THE 16S RIBOSOMAL GENE OF *BORRELIA BURGDORFERI*. Morgan Shipley*, Emmalynn Walvoord, Bailey Hallgren Meehan, and D. Michael Olive, Nebraska Wesleyan University, Lincoln, NE 68504

4:40 22. THE EFFECT OF COMMERCIAL FEED VS CUSTOM FEED ON TILAPIA AND LETTUCE GROWTH IN AQUAPONIC SYSTEMS. Jackson Barnes* and Marc Albrecht, Department of Biology, University of Nebraska-Kearney, Kearney, NE 68849

4:50 23. COMPARISON OF COMMERCIAL AQUAPONIC SYSTEMS: PATENTED VS RECLAIMED. Cody Willmore*, Nate Bickford, and Marc Albrecht, Department of Biology, University of Nebraska at Kearney, Kearney, NE 68849

SESSION D

Session Chairperson: Joe Dolence, University of Nebraska at Kearney
Smith Callen Conference Center

1:00 1. ISOLATION OF THE MAJOR OUTER MEMBRANE PROTEIN FROM *CHLAMYDIA TRACHOMATIS* FOR FUTURE VACCINE DEVELOPMENT. Gustavo Zardeneta[2]*, Douglas Christensen[1], Kristy Hansen[1], [1]Department of Biology, [2]Department of Chemistry, Wayne State College, Wayne, NE 68787

1:10 2. EXAMINING THE POTENETIAL OF *LISTERIA MONOCYTOGENES* INLB AS A TOOL FOR DRUG UPTAKE. Josephine Peitz*, Shawn Pearcy, and Douglas Christensen, Department of Biology, Wayne State College, NE 68787

1:20 3. SUBTOXIC EFFECTS AND MECHANISMS OF METAL NANOPARTICLES ON HUMAN CELLS. Michael Merical, Department of Biology, Nebraska Wesleyan University, 5000 Saint Paul Ave. Lincoln, NE 68504

1:30 4. DESIGN AND EVALUATION OF CNS TARGETED ANTIRETROVIRAL NANOPARTICLES. Andrew Kochvar*[1], Matthew Pon[1], Anne Marie Backer[1], Subhra Mandal[2], Christopher Destache[2], Annemarie Shibata[1], [1]Department of Biology, [2]School of Pharmacy and Health Professions, Creighton University, Omaha, NE 68178

1:40 5. EFFECTS OF HUMAN HOLO-TRANSFERRIN CONJUGATED NANOPARTICLES ON PRIMARY CORTICAL ASTROCYTES, BV2 MICROGLIA, AND PRIMARY RAT NEURONS *IN VITRO*. Anne Marie Backer[1], Andrew Kochvar[1], Matthew Pon[1], Subhra Mandal[2], Christopher Destache[2], Annemarie Shibata[1], [1]Department of Biology, [2]School of Pharmacy and Health Professions, Creighton University, Omaha, NE 68178

1:50 6. QUANTUM DOTS FOR SIMULTANEOUS ASSESSMENT OF ROS AND RADIOSENSITIZATION OF BRAIN CANCER CELLS. Kimal Honour Djam*, Michael Merrick, Haris Akhter, Catherine Weeder and Dr Andrew Ekpenyong, Department of Physics, Creighton University, Omaha, NE 68124

2:00 7. IMPROVING TREATMENT OF NEUROBLASTOMA WITH MIRNA. Eli Lundak*, Dr. Joseph Vetro, Biology Department, Nebraska Wesleyan University, 5000 St. Paul Ave., Lincoln, NE 68504, Center for Drug Delivery and Nanomedicine, S 42nd St & Emile St, Omaha, NE 68198

2:10 8. INVESTIGATION OF CARNITINE PALMITOYLTRANSFERASE II DEFICIENCY IN NEURODEVELOPMENT. Delaney Wilton*[1], Rochelle Wickramasekara[2], Holly Stessman[2], and Annemarie Shibata[1], [1]Department of Biology, [2]Department of Pharmacology and Neuroscience, Creighton University, NE, 68178

2:20 9. USING METABOLIC IMAGING TO QUANTIFY UVA-INDUCED DAMAGE IN SKH-1 MOUSE SKIN. Katie Sotelo*, Lindle Che, Marifel Gabriel, Kelsey Jackson, Dominick Myers, Molly Myers, Laura Hansen, Michael Nichols, Department of Physics, Creighton University, Omaha NE 68178

2:30 10. CORRELATING HISTOLOGY TO METABOLIC IMAGING DATA OF SKH-1 MOUSE SKIN. Molly S. Myers*, Dan L. Che, Marifel Frances Gabriel, Benjamin Huerter, Kelsey Jackson, Katie Sotelo, M.G. Nichols, L. Hansen, Department of Physics, Creighton University, Omaha NE 68178

2:40 BREAK

2:50 11. CHITOSAN ACTS AS AN IMMUNE ACTIVATOR THROUGH STIMULATION OF INNATE IMMUNE SIGNALING PATHWAYS AND CYTOKINE EXPRESSION *IN VITRO*. Matthew D. Ballweg*[1,2], Anna T. Lampe[1,2], Eric Farris[3], Angela K. Pannier[3], Deborah M Brown[1,2], [1]School of Biological Sciences, University of Nebraska-Lincoln, Lincoln, NE, [2]Nebraska Center for Virology, University of Nebraska-Lincoln, Lincoln, NE, [3]Biological Systems Engineering, University of Nebraska-Lincoln, Lincoln, NE 68588

3:00 12. ANNUAL BUGGY CREEK VIRUS PHENOTYPE DYNAMICS IN SWALLOW BUGS (*OECIACUS VICARIUS*). Tyler Rollman*, T. Rowan, B. Ryan, C. Fassbinder-Orth, Department of Biology, Creighton University, Omaha, NE 68178

3:10 13. THE EFFECTIVENESS OF INFRARED CAMERA ON A CONSUMER DRONE (UAS) FOR WILDLIFE IMAGING. Jared Fischer* and Marc Albrecht, Department of Biology, University of Nebraska at Kearney, Kearney, NE 68849

3:20 14. POLLEN TUBE DEVELOPMENT IN WATER-POLLINATED STUCKENIA PECTINATA. Emma C. Baker*, Sabrina D. DuMond*, Neha Lamsal, Christie L. Dang, Mackenzie L. Taylor, Department of Biology, Creighton University, Omaha, NE 68178

3:30 15. DETERMINING THE PREVALENCE OF VECTORED PATHOGENS IN ELKHORN RIVER VALLEY *DERMACENTOR VARIABILIS* IN NEBRASKA. Caitlin Ingram*, Julie Shaffer, Brandon Luedtke, Department of Biology, University of Nebraska at Kearney, Kearney, NE 68849

3:40 16. DEVELOPMENT OF A SYSTEM TO SELECTIVELY RECRUIT CHROMATIN ARCHITECTURAL PROTEINS USING INDUCIBLE HETERODIMERS. Aubrey Schatz*, Brandon Gannon, Nicholas Scalora, and Brett J. Schofield, Department of Biology, Doane University, Crete, NE 68533

3:50 17. INSULATOR PROTEIN SCREEN IN *SACCHAROMYCES CEREVISIAE.* Keegan Whisler*, Nicholas Scalora*, Joe Larkin*, Aubrey Schatz, and Brett J. Schofield, Department of Biology, Doane University, Crete, NE 68533

4:00 18. GROWTH RATE OF A BIOFILM *ARTHROBACTER AURESCENS* TC1 SYSTEM GROWN IN GLUCOSE + ATRAZINE MINIMAL MEDIA. Kate Grint*[1] and Christopher D. Wentworth[2], [1]Department of Biology, [2]Department of Physics & Engineering, Doane University, Crete, NE 68333

4:10 19. EFFECT OF ANDROGEN RECEPTOR ON SELF-GROOMING IN MICE. Tanner Johnson* and Nicholas Hobbs, Department of Biology, University of Nebraska at Kearney, NE 68849

4:20 20. CONSISTENCY OF BEHAVIORAL PLASTICITY ACROSS DIFFERENT SELECTIVE CONTEXTS. Dorsa Motevalli*, Alexandra Basolo, School of Biological Sciences, University of Nebraska-Lincoln, NE 68588

4:30 21. EVOLUTION OF A rRNA GROUP I INTRON IN THE LICHEN *TELOSCHISTES CHRYSOPHTHALMUS*. Audrey Codina* and Dawn M. Simon, Department of Biology, University of Nebraska Kearney, NE 68849

4:40 22. EFFECT OF DIETARY PROTEIN CONTENT ON THE RESPONSE TO OVER-MARKS AND ANDROGEN RECEPTOR EXPRESSION IN MICE. Kaitlyn Schultis* and Nicholas Hobbs, Department of Biology, University of Nebraska at Kearney, NE 68849

4:50 23. WHOLE-GENOME SEQUENCING AND DE NOVO ASSEMBLY OF ENVIRONMENTAL BACTERIA. Sydney Robertson and John Kyndt, Bellevue University, Bellevue, NE.

CHEMISTRY & PHYSICS

CHEMISTRY SECTION

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

8:00 WELCOME

8:05 1. RAPID SCREENING OF DRUG-PROTEIN INTERACTIONS IN DIABETES BY HIGH-PERFORMANCE AFFINITY CHROMATOGRAPHY. Ashley G. Woolfork* and David S. Hage, Department of Chemistry, University of Nebraska-Lincoln.

8:25 2. PSEUDOMONAS AERUGINOSA GROWTH ON TITANIUM AND MODIFIED TITANIUM SUBSTRATES. Jaysa Hoins* and Chris Huber, Department of Chemistry, Doane University, Crete.

8:40 3. ANALYSIS OF SOFT DRINK ADDITIVES ON CARBON DIOXIDE NUCLEATION REACTION RATE IN AQUEOUS SOLUTIONS. Nathan P. Maginnis*, Mary E. Keithly, and Jennifer L. Balmat, Department of Mathematical and Natural Sciences, Chadron State College, Chadron.

8:50 4. BIO PRODUCTION OF ADIPIC ACID FROM LIGNIN-DERIVED AROMATICS USING ENGINEERED PSEUDOMONAS PUTIDA. Howard Willett*, Joshua Mueller, Bin Ma, Xinyuan He, and Wei Niu, Department of Chemical and Biomolecular Engineering, University of Nebraska-Lincoln

9:10 BREAK

9:25 5. CHALLENGES OF USING RATIONAL DESIGN TO OPTIMIZE SUBSTRATE SPECIFICITY FOR THE SURPRISINGLY PROMISCUOUS L-TYPE AMINO ACID TRANSPORTER (LAT1). Brooklynn Venteicher[1], Joseph Griffith[1]*, Karissa Finke[1], Seth Springer[1], Laura Stoner[1], Evan Augustyn[1], Jerome Campbell[1], Colton Hall[1], Huan-Chieh Chien[2], Arik A. Zur[2], Claire Colas[3], Kathleen M. Giacomini[2], Avner Schlessinger[3], and Allen A. Thomas[1]; [1]Department of Chemistry, University of Nebraska at Kearney; [2]Department of Bioengineering and Therapeutic Sciences, Schools of Pharmacy and Medicine, University of California San Francisco, San Francisco, CA, 94158; [3]Departments of Pharmacology and Systems Therapeutics and Structural and Chemical Biology, Icahn School of Medicine at Mount Sinai, New York, NY 10029

9:45 6. CURCUMIN, QUERCETIN AND THEIR COMBINATION FORMULATIONS: CHARACTERIZATION, RELEASE STUDIES, & ANTI-OXIDANT ACTIVITY. Christina Ternent*, College of St. Mary, Omaha.

10:05 7. WHEY PROTEIN AS A CARRIER FOR DELIVERY OF POORLY SOLUBLE ANTIOXIDANTS. Marlene Djidjoho*, Shambhavi Borde, Harsh Chauhan and Dunesh Kumari, Chemistry Department, College of Saint Mary, Omaha and School of Pharmacy and Health Professions, Creighton University, Omaha, NE

10:20 8. CHARACTERIZATION OF CARBOXYLIC ACID REDUCTASES AS CATALYSTS FOR BIOSYNTHESIS OF INDUSTRIAL CHEMICALS. Levi Kramer*, Erome Hankore, Yilan Liu, Kun Liu, Esteban Jimenez, Jiantao Guo, and Wei Niu, Department of Chemical and Biomolecular Engineering, University of Nebraska-Lincoln.

10:35 9. QUANTITATIVE ANALYSIS OF DIALLYL SULFIDE IN TWO GARLIC SUPPLEMENTS. Makala Michka*, Tim Keith, and Jennifer Balmat, Department of Mathematical and Natural Sciences, Chadron State College, Chadron.

11:00 MAIBEN LECTURE

1:00 10. EXAMINATION OF PAO1 BIOFILM COVERAGE USING FLUORESCENCE MICROSCOPY. Tanner Harsin* and Chris Huber, Department of Chemistry, Doane University, Crete.

1:15 11. IMPACT OF GOLD SURFACES ON THE ATTACHMENT AND PROLIFERATION OF PA01 BIOFILMS. Chris Huber*, Department of Chemistry, Doane University, Crete.

1:30 12. MOLECULAR MODELING OF ISOFORM-SPECIFIC INHIBITION OF THE PEROXISOME PROLIFERATOR-ACTIVATED RECEPTOR PPARΓ: IDENTIFICATION OF PPARΓ ANTAGONISTS. Suliman Almahmoud[1]*, Haizhen A. Zhong[2], Jeremy Jones[3], Xiaofang Wang[1], and Jonathan L. Vennerstrom[1], [1]Department of pharmaceutical science, University of Nebraska Medical Center, Omaha, [2]Department of Chemistry, the University of Nebraska at Omaha, [3]Division of Molecular Pharmacology, City of Hope, Duarte, CA.

1:50 13. OBSERVATION OF CARBON DIOXIDE CLATHRATE HYDRATE WHISKER STRUCTURES. Avinash Kumar Both* and Chin Li Cheung, Department of Chemistry, University of Nebraska-Lincoln.

2:05 14. OPTIMIZING THE LINKER FOR LAT1-TARGETED PRODRUGS TO IMPROVE POTENCY AND CELLULAR UPTAKE. Hannah Way[1], Kasey Merklin[1], Jerome Campbell[1], Brooklynn Venteicher[1], Huan-Chieh Chien[2], Claire Colas[3], Avner Schlessinger[3], Kathleen M. Giacomini[2], Allen A. Thomas[1]; [1]Department of Chemistry, University of Nebraska at Kearney, NE, 68849; [2]Department of Bioengineering and Therapeutic Sciences, Schools of Pharmacy and Medicine, University of California San Francisco, San Francisco, CA, 94158; [3]Departments of Pharmacology and Systems Therapeutics and Structural and Chemical Biology, Icahn School of Medicine at Mount Sinai, New York, NY 10029

2:15 15. QUALITATIVE AND QUANTITATIVE ANALYSIS AND IDENTIFICATION OF MENTHOL IN PEPPERMINT TEA. Princess Uba*, Tim Keith, and Jennifer Balmat, Department of Mathematical and Natural Sciences, Chadron State College, Chadron.

2:30 BREAK

2:45 16. DOCKING STUDIES OF BOUND LIGANDS AND FDA APPROVED DRUGS FOR MAPKAP KINASE-2 (MK-2) AS POTENTIAL ANTI-FLU TREATMENT. Michael Meyer* and H. Andy Zhong, Department of Chemistry, University of Nebraska at Omaha.

3:00 17. STEREOSELECTIVE SYNTHESIS OF HOMOALLYLIC ALCOHOLS BY DOUBLE HYDRIDE REDUCTION. Brianna L. Callahan and Martin Hulce*, Department of Chemistry, Creighton University, Omaha.

3:20 18. FLUOROPHORE SUBSTITUTED 1,2,3-TRIAZOLIUM SALTS. Connor A. Lejcher* and James T. Fletcher, Department of Chemistry, Creighton University, Omaha.

3:35 19. BIDENTATE CHELATORS WITH 1,2,3-TRIAZOLE AND ISOQUINOLINE SUBUNITS. Nicholas W. Kreofsky* and James T. Fletcher, Department of Chemistry, Creighton University, Omaha.

3:50 20. CAVITAND-MEDIATED PHOTOCYCLOADDITION OF ARYL-ETHYLENES AND ITS APPLICATION IN MANIFESTING SUPRAMOLECULAR INTERACTION. Mahesh Pattabiraman, University of Nebraska-Kearney, Kearney.

4:05 21. THE HYDROPATHY SCALE AS AN EFFECTIVE PREDICTOR OF THE INFLUENCE OF AMINO ACIDS ON THE HYGROSCOPIC PROPERTIES OF SODIUM CHLORIDE AEROSOLS. Joshua P. Darr*, Salvatore Gottuso, Mohammed Alfarra, David Birge, Kimberly Ferris, Dillon Woods, Paul Morales, Megan Grove, William K. Mitts, Eduardo Mendoza-Lopez, and Amissabah Johnson, Department of Chemistry, University of Nebraska at Omaha.

4:25 BUSINESS MEETING

CHEMISTRY AND PHYSICS

PHYSICS SECTION

Chairperson: Adam N. Davis
Wayne State College
Acklie Hall Room 320

9:00 WELCOME

9:05 1. MODELLING OPTICAL LIGHT CURVES OF AGNS USING VARIABLEVISCOSITY PARAMETER. Shrey Ansh, Department of Physics, Creighton University, Omaha, NE 68718

9:15 2. INCOHERENT PHOTOPRODUCTION OF Φ-MESON IN ULTRA-PERIPHERAL PB+PB COLLISIONS AT √S_NN = 5.02 TEV. Amrit Gautam, Department of Physics, Creighton University, Omaha, NE 68718

9:30 3. SOFTWARE UPDATES TO STAR, THE SOLENOIDAL TRACKER AT RHIC RELATIVISTIC HEAVY ION COLLIDER), AT BROOKHAVEN NATIONAL LABORATORIES. Emma Dufresne, Department of Physics, Creighton University, Omaha, NE 68718

9:40 4. CONSTRAINTS ON THE GEOMETRY OF QUASAR SPECTRA. Leo Moraczewski*, Jack Gable, Department of Physics, Creighton University, NE, 68178

9:50 5. BIG DATA ANALYTICS IN ASTRONOMY: APPLICATIONS IN QUASAR RESEARCH. Samantha Hughes* and Dr. Jack Gabel, Department of Physics, Creighton University, NE 68102

10:00 6. SEARCH FOR HC PARTICLES IN HEAVY ION ULTRAPERIPHERAL COLLISIONS. Alec Peck, Department of Physics, Creighton University, NE 68102

10:15 7. MATHEMATICAL MODELING OF CELL ATTACHMENT AND MIGRATION FOR PHYSICS OF CANCER. Andrew Walther*, Michael Mimlitz, and Dr Andrew Ekpenyong, Department of Physics, Creighton University, NE 68102

10:25 8. SIMULATIONS OF AGN OUTFLOWS AS ACCRETION DISK WINDS. Margaret Johnston*, Jack Gabel, Department of Physics, Creighton University, NE 68102

11:00 MAIBEN LECTURE

1:20 9. BALLISTIC TESTS OF MULTILAYERED ARMORED COMPOSITES. Tyler Parthemer, Department of Physics, Hastings College, Hastings, NE 68901

1:40 10. DESIGN AND CONSTRUCTION OF AN ELECTRIC DRIVE SYSTEM FOR A DIRT BIKE. Ashton Oakman, Department of Physics, Hastings College, Hastings, NE 68901

2:00 11. HEAVY-LIFT AUTONOMOUS DRONE. Jason Finnegan, Department of Physics, Hastings College, Hastings, NE 68901

2:20 12. ANALYSIS OF THE ACCURACY AND FIRE REPEATABILITY OF A HIGH VELOCITY RAILGUN. Andrew Rutt, Department of Physics, Hastings College, Hastings, NE 68901

2:40 13. PHOTOMETRIC ANALYSIS OF BLAZARS. Lyndsay Ruane, Department of Physics, Hastings College, Hastings, NE 68901

EARTH SCIENCE

Chairperson: Irina Filina
Department of Earth and Atmospheric Sciences, University of Nebraska-Lincoln
Acklie Hall Room 007

1:00 WELCOME

1:05 1. INVESTIGATING THE ONSET OF THE CAMPANIAN–MAASTRICHTIAN BOUNDARY EVENT AT DSDP HOLE 762C USING CALCAREOUS NANNOFOSSIL BIOMTERICS AS A TEMPERATURE PROXY. Shamar Chin* and David K. Watkins, Department of Earth and Atmospheric Sciences, University of Nebraska at Lincoln, 68588

1:25 2. PALEONTOLOGY LOCALITY RECORDS. Robert L. Evander, 1218 West 4th, Hastings NE 68901

1:40 3. A MOPHOMETRIC STUDY OF RABBITS FROM THE WHITE RIVER AND ARIKAREE GROUPS (CHADRONIAN THROUGH ARIKAREEAN) IN THE PANHANDLE OF NEBRASKA AND SOUTHERN SOUTH DAKOTA. Maria Peterson* and Michael B. Leite, Department of Mathematical and Natural Sciences, Chadron State College, Chadron, NE 69337

1:50 4. DETERMINATION OF HEAVY METAL SPECIES IN RESERVOIR SEDIMENTS OF THE PINE RIDGE-BLACK HILLS REGION, NEBRASKA AND SOUTH DAKOTA, USA. Greggory L. Peterson*, Tim Keith, Jennifer L. Balmat, Michael B. Leite, Department of Mathematical and Natural Sciences, Chadron State College, Chadron, NE 69337

2:05 5. THE CONTACT BETWEEN PEORIA LOESS AND THE GILMAN CANYON FORMATION IN THE KEARNEY AREA, SOUTH-CENTRAL NEBRASKA. Jeremy S. Dillon*, Zachary Albrecht, Claire Christner, Theodore Degner, and Brian Guerra, Department of Geography, University of Nebraska at Kearney, NE 68849

2:20 BREAK

2:30 6. SUDDEN SEISMICITY SPIKE IN CENTRAL NEBRASKA IN 2018. Irina Filina*, Kris Guthrie, Caroline M. Burberry and Mindi Searls, Department of Earth and Atmospheric Sciences, University of Nebraska – Lincoln, NE 68588

2:45 7. VARIATIONS IN SUBSURFACE SEISMIC VELOCITIES IN CENTRAL NEBRASKA DETERMINED FROM 2018 EARTHQUAKE CLUSTER. Hannah Botten*, Irina Filina, Department of Earth and Atmospheric Sciences, University of Nebraska – Lincoln, NE 68588

3:00 8. GEOPHYSICAL ANALYSIS OF THE MIDCONTINENT RIFT'S SUBSURFACE STRUCTURES IN SOUTHEASTERN NEBRASKA. Patrick Szopinski*, Irina Filina, Department of Earth and Atmospheric Sciences, University of Nebraska – Lincoln, NE 68588

3:15 9. ASSEMBLING THE HUSKER SEISMOMETER. Evan Parsons*, Irina Filina, Department of Earth and Atmospheric Sciences, 68588 and Anatoly Mironov, Department of Physics and Astronomy, University of Nebraska at Lincoln, NE 68588

3:30 10. DEVELOPING A DRONE-BASED MAGNETIC FIELD SURVEYING SYSTEM. Erik Jacobson*, Irina Filina, Department of Earth and Atmospheric Sciences, University of Nebraska at Lincoln, NE 68588

3:45 ADJOURN

ENVIRONMENTAL SCIENCES

Chairperson: Mark Hammer
Wayne State College
Acklie Hall Room 111

1:00 WELCOME

1:05 1. BERGMANN'S RULE TESTED ON SNAKES NATIVE TO THE UNITED STATES AND CANADA. Ria Shome*, Dr. Gary Gerald, Department of Biology, Nebraska Wesleyan University, 5000 St. Paul Avenue, Lincoln, NE 68504

1:25 2. DEVELOPING AN EXTRACTION METHOD FOR HPLC DETECTION OF ARTHROBACTER AURESCENS TC1 ATRAZINE BIOREMEDIATION. Hunter Kleinschmidt, Jared Hass, Michael Kangas, Christopher Wentworth, Chris Huber, Andrea E Holmes, Arin L. Sutlief*, Doane University, Crete, NE.

1:40 3. PHYTOREMEDIATION OF HEAVY METAL CONTAMINANTS Kristy Hansen*, Mark Hammer, Department of Biology, Wayne State College, Wayne, NE 68787

1:50 4. HABITAT SELECTION AND SPATIAL DISTRIBUTION OF EASTERN COTTONTAIL RABBITS IN A FRAGMENTED AGRICULTURAL LANDSCAPE. Jourdan M Ringenberg*, Nate Bickford, Matt Bice, and Dustin H Ranglack, Department of Biology, University of Nebraska at Kearney, NE 68849

TEACHING OF SCIENCE AND MATH

Chairperson: Josef Kren
Bryan College of Health Sciences, Lincoln
Acklie Hall Room 218

1:00 WELCOME

1:05 1. ADDING RELEVANCE TO A NONMAJORS BIOLOGY COURSE. Phyllis Higley, College of Saint Mary, Omaha, NE.

1:20 2. APPLICATIONS OF A RANKING TASK EDITOR IN ASTRONOMY EDUCATION. Brandon T. Harper*, Christopher M. Siedell, and Kevin M. Lee, University of Nebraska – Lincoln, NE.

1:35 3. GROWING PATHWAYS TO STEM: USING RESEARCH FRAMEWORKS, COMMUNITY PARTNERSHIPS, AND INTENSIVE MENTORING TO EXPAND STEM CAREER PATHWAYS FOR RURAL COMMUNITY COLLEGE STUDENTS. Lauren M. Gillespie* and Steve Heinisch, Department of Academic Education, Central Community College, Columbus, NE. Neal Grandgenett, Department of STEM Education, College of Education, University of Nebraska-Omaha, NE.

1:50 4. WHAT CURRENT RESEARCH CAN TEACH MEDICAL PERSONNEL ABOUT SEPSIS MANAGEMENT AND TREATMENT. Emily Klein*, Britta Robinson, Ashley Holm and Bri Aguilar. Bryan College of Health Sciences, Lincoln, NE.

2:05 5. USING DEMONSTRATION VIDEOS. Emily A. Welch*, Kevin M. Lee and Lisa Pytlik-Zillig, Department of Physics and Astronomy, University of Nebraska - Lincoln, NE.

2:25 6. MAKING "SCENTS" OF ESTER CHEMISTRY: DEVELOPING A SOPHOMORE ORGANIC CHEMISTRY LABORATORY. Martin Hulce, Department of Chemistry, Creighton University, Omaha, NE.

COLLEGIATE ACADEMY

BIOLOGY

Chairperson: Therese McGinn
Nebraska Wesleyan University, Lincoln

SESSION A

Olin Hall Room 111

8:36 1. USING HYBRIDIZATION AND SELECTION TO EFFECTIVELY DEVELOP IMAZAMOX-RESISTANT WHEAT. Laurel Heskett*[1], P. Stephen Baenziger[2], [1]Department of Biology, Nebraska Wesleyan University, NE 68504. [2]Department of Agronomy and Horticulture, University of Nebraska at Lincoln, NE 68503

8:48 2. MICROPLASTIC POLLUTION IN SALT CREEK SURFACE WATERS: QUANTITY AND COMPOSITION. Margaret A. Eubanks*[1], Jerald S. Bricker[1], Shannon L. Bartelt-Hunt[2], and Daniel D. Snow[2], [1]Department of Biology, Nebraska Wesleyan University, Lincoln, NE 68504, [2]University of Nebraska – Lincoln

9:00 3. TRANSCRIPTOME ASSEMBLY AND DIFFERENTIAL GENE EXPRESSION ANALYSIS OF THE COMMON CORN SNAKE, PANTHEROPHIS GUTTATUS. Dan Novinski*, Adrianne Prokupek-Pickett, and Gary Gerald, Department of Biology, Nebraska Wesleyan University at Lincoln, NE 68504

9:12 4. THE ADAPTIVE FUNCTION OF COTTONTAIL RABBIT (SYLVILAGUS FLORIDANUS) TAIL-FLAGGING USED TO AVOID PREDATION. Bailey Hallgren Meehan*, Cody Arenz, and Gary Gerald, Department of Biology, Nebraska Wesleyan University, 5000 St. Paul Ave, NE 68504

9:24 5. EFFECTS OF A LARGE MEAL ON THE LIMBLESS LOCOMOTION OF THE COMMON CORN SNAKE (PANTHEROPHIS GUTTATUS). Brooke Henson*, Ria Shome, Carmen Juan, Connor Springman, and Gary Gerald, Department of Biology, Nebraska Wesleyan University, 5000 Saint Paul Ave Lincoln, NE 68504

9:36 6. THE EFFECTS OF CAFFEINE AND EXERCISE ON ULNAR NEURAL IMPULSE SPEEDS. Kai Friesen*, Cindy Marolf, Gary Gerald, Department of Biology, Nebraska Wesleyan University, Lincoln, NE 68504

COLLEGIATE ACADEMY

BIOLOGY

Chairperson: Angela McKinney
Nebraska Wesleyan University, Lincoln

SESSION B

Olin LH-B

8:00 1. EVALUATION OF THE "TAIL DROP" HYPOTHESIS IN HUMAN CHASED SYLVILAGUS FLORIDANUS IN NEBRASKA. Margaret Polland*, Cody Arenz, and Gary Gerald, Nebraska Wesleyan University, Lincoln, NE.

8:12 2. AGGRESSIVE PREWARMING MEASURES DECREASED PERIOPERATIVE HYPOTHERMIA IN OUTPATIENT SURGERY CENTER PATIENTS. Tara Benes, Department of Biology, Nebraska Wesleyan University, NE 68504

8:24 3. THE EFFECTS OF CAFFEINE ON BRAIN ACTIVITY POST-EXERCISE. Dalton McGerr, Department of Biology, Nebraska Wesleyan University at Lincoln, NE 68504

8:36 4. EFFECTS OF LEG POSITION AND TIME ON THE LOCOMOTION OF SPIDERS (PHOLCUS MANUELI) AFTER AUTOTOMY. Mariah M. Fallick*, Clement Bonnardel, Gary W. Gerald, Department of Biology, Nebraska Wesleyan University, 5000 Saint Paul Ave, Lincoln, NE 68506

8:48 5. MUNICIPAL WASTEWATER AS A SOURCE OF MICROPLASTIC POLLUTION IN SALT CREEK SEDIMENTS. Aly B. Johnson*[1], Jerald S. Bricker[1], and Daniel D. Snow[2], [1]Department of Biology, Nebraska Wesleyan University, NE 68504, [2]School of Natural Resources, University of Nebraska at Lincoln, NE 68588

9:00 6. EFFECTS OF PEDIATRIC CONGENITAL HEART DISEASE ON KBIT-2 SCORES COMPARED TO HEALTHY CHILDREN. Alexander Vraspir*[1,2], Holly Roberts[2], Howard Needelman[2], [1]Department of Biology, Nebraska Wesleyan University, Lincoln, NE, 68504, [2]Munroe-Meyer Institute for Genetics and Rehabilitation, University of Nebraska Medical Center, Omaha, NE, 68105

9:12 7. ESCHERICHIA COLI CAUSING URINARY TRACT INFECTIONS AND DIARRHEAL DISEASES. Julia Bartolome* and D. Michael Olive, Department of Biology, Nebraska Wesleyan University, NE 68504

9:24 8. EFFECTS OF CAFFEINE COUPLED WITH EXERCISE ON GRIP STRENGTH AND REACTION TIME. Grant Albers, Department of Biology, University of Nebraska Wesleyan, Lincoln, NE, 68504

9:36 9. COMPARISON OF ANTIBIOTIC RESISTANCE AND VIRULENCE GENES IN ESCHERICHIA COLI ISOLATED FROM STUDENT HEALTHCARE WORKERS AND STUDENT NON-HEALTHCARE WORKERS. Tress Nelson* and Michael Olive, Department of Biology, Nebraska Wesleyan University, NE 68504

9:48 BREAK

10:00 10. INTEGRIN ALPHA 8 AND PROTOCADHERIN-15 KNOCKDOWNS IN OC-1 STEREOCILIA ASSOCIATED WITH USHER'S SYNDROME. Nate Teitler*[1,2], Marissa Zallocchi[1], [1]Boys Town National Research Hospital, Molecular Genetics Lab, 555 N 30th St, Omaha, NE 68131, [2]Department of Biology, Nebraska Wesleyan University, 5000 St. Paul Ave, NE 68504

10:12 11. BACTERIOPHAGE MS2 AS A SURROGATE MODEL FOR STUDYING NOROVIRUS. Grant Bednar*, Michael Olive, Department of Biology, Nebraska Wesleyan University, NE 68504

10:24 12. PRO-INFLAMMATORY EFFECTS AND CYTOTOXICITY OF ACETALDEHYDE AND MALONDIALDEHYDE. Tyler Sharp*[1,2], [1]Department of Internal Medicine, University of Nebraska Medical Center, Omaha, NE, 68131, [2]Department of Biology, Nebraska Wesleyan University, Lincoln, NE, 68504

10:36 13. TRADE-OFFS BETWEEN WINGSPAN AND LIFE HISTORY TRAITS IN BIRDS. Karrie Sestak* and Gary Gerald, Nebraska Wesleyan University, Lincoln, NE

11:00 MAIBEN LECTURE

1:00 14. NITROGEN FIXERS IN THE MAIZE RHIZOSPHERE AND ANALYSIS OF THEIR MBOA SENSITIVITY. Frederick Azalekor*, Florian Wurtele, Martha Lopez-Guerrero, and Karin van Dijk, Department of Biochemistry, University of Nebraska at Lincoln, NE 68588

1:12 15. PSEUDOMONAS AERUGINOSA PERSISTER CELL QUANTIFICATION USING A MICROFLUIDIC DEVICE. Marco Perez, Doane University, Crete, NE.

1:24 16. COMPARISON OF GROWTH RATES OF SUSPENDED AND BIOFILM CELLS OF PROTEUS MIRABILIS GROWN IN TSB. Michael Wieduwilt*[1] and Christopher D. Wentworth[2], Doane University, Crete, NE 68333, [1]Department of Biology, [2]Department of Physics & Engineering

1:36 17. FOURIER ANALYSIS OF MICROSCOPIC IMAGES OF PSEUDOMONAS AERUGINOSA BIOFILMS GROWN UNDER CHANGING SHEAR STRESS CONDITIONS. Sarah Vaughn* and Christopher D. Wentworth, Department of Physics & Engineering, Doane University, Crete, NE 68333

1:48 18. BREEDING BLUEBIRDS AND INVASIVE ANTS: INFLUENCE OF RESOURCE COMPETITION OR PREDATION ON NESTLING SEX RATIOS. Andrew Herley*, Lauren M. Gillespie*, Department of Academic Education, Central Community College, Columbus, NE, 68602, Paige Reimers, University of Nebraska-Lincoln, Lincoln, NE 68588, Lynn Siefferman, Dept. of Biology, Appalachian State University, Boone, NC 28608

2:00 19. DESCRIPTION OF POSSIBLE HYBRID BARN X CLIFF SWALLOWS IN EAST CENTRAL NEBRASKA IDENTIFIED VIA ANOMALOUS PLUMAGE VARIATION. Kayla Kreizel*, Elizabeth Ewing, Alejandro Espino, Jenessa Grooms, Alex Koch, Steve Heinisch, Lauren Gillespie*, Department of Academic Education, Central Community College, Columbus Nebraska, 68602.

2:12 20. ANALYSIS OF RNAseq DATA REVEALS MEDIA STATE DEPENDENT TRANSCRIPT PROFILE IN CANDIDA ALBICANS. Patricia Harte-Maxwell, Department of Biology, University of Nebraska at Omaha, NE 68182

2:24 BREAK

2:36 21. DAY TO DAY AND LEG TO LEG VARIATION IN SKELETAL MUSCLE GENE EXPRESSION. Zohal Alizai, University of Nebraska-Omaha, Omaha, NE.

2:48 22. ESTROGEN POSITIVELY AFFECTS SPATIAL DISCRIMINATION IN ADULT FEMALE OVARIECTOMIZED RATS. Raissa Souza*[1,2], Sejal Chudasama[2], Justin Garrel[2], Henry Blair[2], and Jana Veliskova[2], [1]Biology Department, Nebraska Wesleyan University, NE 68504. Dept of Cell Biology, [2]New York Medical College, NY 10595

3:00 23. DEFINING NEUROLOGICAL DISABILITY IN SJÖGREN-LARSSON SYNDROME AND THE SEARCH FOR A BIOMARKER. William B. Rizzo and Morgan L. Zabel*, Department of Pediatrics, University of Nebraska Medical Center, 42nd and Emile St., Omaha, NE 68198 and the Department of Biology, Nebraska Wesleyan University, 5000 St. Paul Ave, Lincoln, NE 68504.

3:12 24. ACTIVITY OF METABOLIC ENZYMES IN SERPENTINE SKELETAL MUSCLE RESULTING FROM DIFFERENT METHODS OF LIMBLESS LOCOMOTION. Paul Wurtz, Department of Biology, Nebraska Wesleyan University, Lincoln, NE, 68504

3:24 25. SKELETAL MUSCLE MITOCHONDRIAL BIOGENESIS IN RESPONSE TO EXERCISE AND COLD EXPOSURE. Camille Larson*, Megan Vande Hei, and Dustin Slivka, Department of Health and Kinesiology, University of Nebraska at Omaha, NE 68182

3:36 26. IMPACTS OF EXERCISE AND ENVIRONMENTAL TEMPERATURE ON MITOCHONDRIAL QUANTITY AND QUALITY. Halee Keller*, Robert Shute, Dustin Slivka, University of Nebraska-Omaha, Omaha, NE

COLLEGIATE ACADEMY

CHEMISTRY AND PHYSICS

Chairperson: Nathanael Fackler
Nebraska Wesleyan University, Lincoln
Acklie Hall Room 007

8:25 WELCOME

8:30 1. TRACKING UV-INDUCED CANCER DEVELOPMENT USING A MULTI-PHOTON PHASOR FLUORESCENCE LIFETIME IMAGING MICROSCOPY SETUP. Kelsey A. Jackson*, Marifel F. Gabriel, Dominick M. Myers, Molly Myers, Katie D. Sotelo, Laura Hansen, Michael Nichols, Department of Physics, Creighton University, NE 68178.

8:47 2. MULTI-PHOTON FLUORESCENCE LIFETIME IMAGING MICROSCOPY OF NAD(P)H PHASOR ANALYSIS CHARACTERIZES THE METABOLIC CHANGES IN CHRONIC UVA EXPOSED SKH-1 MICE. Marifel F. Gabriel*, Kelsey A. Jackson, Dominick M. Myers, Molly S. Myers, Katie D. Sotelo, Lindle D. Che, Laura Hansen, Michael G. Nichols, Department of Physics, Creighton University, NE 68178.

9:05 3. IDENTIFYING THE BINDING LOCATION OF ATRAZINE AND ITS METABOLITES ON HSA USING HIGH PERFORMANCE AFFINITY CHROMATOGRAPHY. Kati Frankenberg* and Annette C. Moser, Department of Chemistry, University of Nebraska at Kearney, NE 68849.

9:22 4. INTRODUCTION TO EPICS-BASED CONTROLS FOR THE STAR EXPERIMENT AT BROOKHAVEN NATIONAL LABORATORY. Raelynn McCreary, Creighton University, Omaha, NE 68178.

9:35 5. FEASIBILITY OF MEASURING THE Φ MESON PHOTOPRODUCTION IN ULTRA-PERIPHERAL COLLISIONS AT STAR. Ethan Wahle, Creighton University, Omaha, NE 68178.

9:47 6. USING AMINO ACIDS IN THE FIGHT AGAINST ANTIBIOTIC RESISTANCE. Caitie Lemmons*, Jonah Scheffler, and David Peitz, Chemistry, Wayne State College, 1111 Main St., Wayne, NE.

10:05 7. UPGRADES TO SAFETY SYSTEM SOFTWARE FOR THE STAR EXPERIMENT SLOW CONTROLS AT BROOKHAVEN NATIONAL LABORATORY. Joey D'Alesio and Sam Ruiz, Creighton University, Omaha, NE 68178.

10:22 8. NANOPARTICAL PALLADIUM HYDROGENATION CATALYSIS OF ALKYNES. THE VINYL REVERSAL AND HORIUTI-POLANYI MECHANISMS. Mackenzie Enmeier*, Kara Grossman, Grace Recker, Katie Cunningham, and Bruce Mattson, Department of Chemistry, Creighton University, Omaha, NE 68178.

PROCEEDINGS

AERONAUTICS AND SPACE SCIENCE

SESSION A

ENHANCED ULTRASONIC CHARACTERIZATION OF METAL ADDITIVELY MANUFACTURED PARTS USING HYBRID CAPABILITIES.

Luz D. Sotelo*, Michael Sealy, Cody Kanger, Rakesh Kumar, Joseph A. Turner, Department of Mechanical and Materials Engineering, University of Nebraska – Lincoln.

Metal additive manufacturing (AM) is employed to make highly specialized low volume mechanical components, which often have challenging performance and reliability requirements. Ultrasonic methods have been used previously to characterize AM parts, but measurements are possible only when the geometry of features is known accurately. In this work, a hybrid direct energy deposition AM system is exploited to quantify geometry while ultrasound is used to interrogate successive layers in situ. First, the ultrasonic properties of the build plate are quantified spatially. Then, measurements of phase velocity and attenuation are made during manufacturing of Ti6Al4V samples to assess the effective modulus and microstructure, respectively, on a layer-by-layer basis. The results highlight the improved geometric information offered by a hybrid AM system in order to assess part mechanical properties. Finally, the limits of this approach with respect to quantitative values are examined and prospects for more complex geometries are discussed.

VOXEL IMAGE FORMATIONS USING SUPERIMPOSED LASER BEAMS.

Auston Viotto, Department of Mechanical & Materials Engineering, University of Nebraska Lincoln.

This research evaluates a method to create holographic images, 3 dimensional images, by manipulating a voxel, volumetric pixel, through the air. A voxel is a point where a superimposed/ culminated laser beams gain a noticeable increase in light scattering due to the Rayleigh Scatter Effect. This increase is due to an increase in beam energy density which creates a bright point in the air. Research will be on designing rotating wedge prism lenses working in tandem for control beam steering and ultimately used to draw 3D images. These lenses will sit in between two frictionless magnetic bearings and rotated by a stator ring in between each bearing. Evaluating the speed at which this system can steer the beam as well as the bounding limits to drawing an image and the clarity of imaging will be compared to traditional use of scanning galvanometric mirrors for creating latent holographic images. Research will also include improvements to the quality and brightness of voxels. This includes increasing the power output of the laser while still maintaining safe optical viewing and lens design to increase focusing of the laser beams while also decreasing early laser beam convergence to reduce voxel brightness gradients. The NASA Nebraska Space Grant funded this research. Keywords: voxel, superposition, Rayleigh Scattering Effect, latent image, voxel gradient

HIGH EMISSIVITY SURFACES PRODUCED USING FEMTOSECOND LASER SURFACE PROCESSING FOR THERMAL MANAGEMENT OF SATELLITES.

Andrew Reicks*, Alfred Tsubaki, Dennis Alexander, and Craig Zuhlke, Department of Electrical and Computer Engineering, Jace Wieseler, Edwin Peng, Mark Anderson, and George Gogos, Department of Mechanical and Materials Engineering, University of Nebraska-Lincoln.

Femtosecond laser surface processing (FLSP) is a laser-based surface functionalization

technology that can be used to create a variety of unique micro/nanoscale surface features. In multidisciplinary project we investigated the use of FLSP to produce high emissivity surfaces on aluminum 6061, and stainless steel 304. High emissivity surfaces are used for cooling electronics on satellites by radiating the heat to space. By controlling FLSP parameters, including laser fluence and pulse count, a wide range of surface structures were produced on both materials, including laser-induced periodic surface structures (LIPSS), mounds, pits, and pyramids. With the FLSP studies carried out for this project, various emissivity levels were obtained and were found to be dependent on the type of surface microstructures produced. By altering the laser processing parameters over a series of iterations, with feedback from emissivity measurements, the surface structures were optimized for high hemispherical emissivity in the targeted wavelength range (1.5 to 21 um). On aluminum, mound-like structures resulted in the highest emissivity. These round microstructures have an aspect ratio around 2:1 and are covered in a thin layer of nanoparticles (< 2 um). On stainless steel, pyramid-like structures resulted in the highest emissivity. These structures are primarily characterized by a pyramidal shape, a 1:1 aspect ratio, and a thick layer of nanoparticles (> 2 um) overlaying the base microstructure. These FLSP surfaces offer emissivity values comparable to the highly emissive paints currently used on satellites. FLSP surfaces have a number of advantages over the paints that are currently used on satellites including permanency and not adding any weight to the system.

EXPERIMENTAL INVESTIGATION OF TWO-DIMENSIONAL DROP COALESCENCE IN LIQUID-AIR SYSTEMS.

Jacob Gottberg*, Haipeng Zhang, and Sangjin Ryu, Department of Mechanical and Materials Engineering, University of Nebraska-Lincoln.

Two-dimensional (2D) drop coalescence in liquid-air systems confined by parallel plates has had limited investigation, and the fluid dynamics resulting from the phenomenon are not fully understood. Fluid coalescence, where two bodies of fluid converge upon contact, plays an important role in several industrial applications. Certain applications, such as the selective laser sintering (SLS) process in additive manufacturing, see coalescence with geometric confinement. In SLS, metallic powder is melted by a laser and coalesces to form solid parts. By modeling these applications as 2D coalescence, the fluid dynamics involved in these processes can be examined by performing larger-scale experiments which can be performed in a laboratory setting. Understanding the fluid dynamics of coalescence will give insight to the origin of the poor material properties resulting from the SLS process. Improving the SLS process would greatly benefit the aerospace industry and NASA, allowing complicated parts to be manufactured to their high-performance standards. Two-dimensional coalescence was reproduced in a thin PDMS-based microchannel device and observed with high-speed video microscopy. The high-speed video was analyzed using MATLAB-based image processing software. From this, coalescing neck growth was measured. Scaling behavior of neck growth was visualized for different fluid properties and geometric parameters. Additionally, it was discovered that under certain conditions 2D coalescence produces a series of bubbles.

FLUID DYNAMICS OF TWO-DIMENSIONAL LIQUID PINCH-OFF.

Stephanie Vavra*, Haipeng Zhang, and Sangjin Ryu, Department of Materials and Mechanical Engineering, Charles Riedesel, Department of Computer Science and Engineering, University of Nebraska-Lincoln.

Liquid toy timers of many different sizes and shapes are a fascination to people of all ages because of the interesting liquid drop formation that takes place inside of the toy. Especially in hourglass-shaped timers, the liquid drops in two-dimensional (2D) space forming two droplet necks before pinch-off. The fluid dynamic principle behind this unique 2D pinch-off was studied by

experimenting with the hourglass-shaped toy timer. These liquid toy timers are composed of colored water which flows through transparent oil. After analyzing the fluidic properties of the colored water in the transparent oil such as viscosity and surface tension, image-processing programs such as MATLAB and ImageJ were used to measure the decreasing droplet neck width by analyzing videos frame-by-frame. After understanding the 2D liquid pinch-off that occurs within this specific toy timer, educators will be able to use similar experiments to teach students about the fluid dynamic principle found in the toy. Teachers can easily buy hourglass toy timers and use a smartphone's slow-motion video capability to capture the liquid drop formation. Lastly, this research can be used to help with the development of a more compact liquid drop generator for planet exploration. Liquid drop generators are used to obtain soil samples on other planets and are comprised of complex tubing equipment. With knowledge about gravity-driven 2D drop formation, a smaller drop generator could be developed to make soil sample collection easier and more efficient.

SPARK PLASMA SINTERING FOR ISRU-ORIENTED LUNAR SIMULANT SOLIDIFICATION.

Xiang Zhang and Bai Cui, Department of Mechanical and Materials Engineering, Mahdieh Khedmati and Yong-Rak Kim*, Department of Civil Engineering, University of Nebraska-Lincoln.

The goal of this research is to investigate the feasibility of the spark plasma sintering (SPS) technology to manufacture construction components using lunar soil for aerospace applications. Solidification of lunar soil is considered a core mission to produce various kinds of infrastructure materials that can build structural components (such as landing pads of spacecrafts) on surface of the Moon. Considering a number of challenges in using resources available on Earth to produce proper construction materials for the Moon, this research is particularly directed to the concept of the ISRU (in-situ resource utilization) by targeting to develop an appropriate solidification technology that is only based on in-situ resources. Toward that end, this study used a novel spark plasma sintering (SPS) process to solidify lunar soil simulants (FJS-1) as potential structural materials in the mission of space exploration. Compared to conventional pressureless sintering, SPS can accelerate the densification process of FJS-1 because of the applied pressure and pulse electric current, which may contribute to accelerated atomic diffusion and the rearrangement and plastic deformation of particles. The effect of SPS conditions, such as temperature and pressure, on the densification behavior, microstructural evolution, phase transformation, and nanomechanical properties of FJS-1 has been investigated. The density of the SPSed samples increased with the sintering temperature. During the SPS of FJS-1, phase transformation from anorthite and pigeonite to augite and jadeite, and glass formation from the decomposition of jadeite occurred as the sintering temperature increased above 900 ºC. At 1050 ºC, a dendritic schorlomite crystal formed from the dissolution of iron titanium oxide particles. The microhardness of SPSed samples was 9.2% higher than pressureless sintered samples.

CONVERSION OF CALCIUM CARBONATE INTO METHANE AND MULTI-CARBON COMPOUNDS BY A NOVEL MICROBIAL CONSORTIUM.

Nicole A. Fiore*, Rebecca V. Kiat, Donald Pan, Caitlin Lahey and Karrie A. Weber, School of Biological Sciences, Nicole R. Buan, Department of Biochemistry, University of Nebraska-Lincoln, Rebecca A. Daly and Kelly C. Wrighton, Department of Crop and Soil Sciences, Colorado State University, Fort Collins.

The microbial conversion of CO2 into methane or multi-carbon compounds offers an alternative approach for renewable energy storage and bio-product production. Here we present preliminary results assessing the conversion of sequestered CO2 in the form of carbonate minerals into methane and acetate

using a microbial consortium enriched from the saline, alkaline wetlands near Lincoln, NE. Shotgun metagenomic sequencing and genome assembly of the enrichment identified an acetogen (Clostridium sp.) and a methanogen (Methanobacterium sp.), and additionally Pseudomonas sp., Desulfovibrio sp., and Tessaracoccus sp. Genomic data suggest the possible conversion of carbonate into acetate coupled to the oxidation of H2 by the Clostridium sp. The acetate or inorganic carbon may be used by the Methanobacterium sp. to generate CH4 via acetogenic or hydrogenotrophic methanogenesis. The enrichment was maintained at an alkaline pH (8.3) under anoxic (100% Ar) conditions when provided with calcium carbonate and either electric current or H2 as an electron source. With optimization, this process could be used on Earth or in space to address the storage limitations of wind and solar power by producing methane gas or multi-carbon compounds. Carbonate deposits on Mars, for example, could be used as a feedstock for on-site fuel generation, eliminating the need for interplanetary fuel transport.

RECIPROCAL FOREARM FLEXION-EXTENSION RESISTANCE TRAINING ELICITS COMPARABLE INCREASES IN MUSCLE STRENGTH AND SIZE WITH AND WITHOUT BLOOD FLOW RESTRICTION.

Ethan Hill*, Terry Housh, Joshua Keller, Cory Smith, John-Paul Anders, Richard Schmidt, and Glen Johnson, Department of Nutrition and Health Sciences, University of Nebraska Lincoln.

The purpose of this investigation was to examine the effects of short-term resistance training with BFR (RT+BFR), resistance training without BFR (RT), and BFR without resistance training (BFR) on muscle strength, hypertrophy, and neuromuscular adaptions. Forty women volunteered to participate in this investigation and were randomly assigned to either RT+BFR (n = 10), RT (n = 10), BFR (n=10), or control (n=10). Resistance training included 75 (1×30, 3×15) repetitions of reciprocal isokinetic forearm flexion-extension muscle actions performed at 30% of concentric peak torque relative to forearm flexion and forearm extension strength, respectively. Training was performed 3 times per week for 4-wks. Muscle strength increased similarly for RT+BFR and RT after 2-wks (13.1 and 13.4%, respectively) and 4-wks (36.9% and 25.8%, respectively) that was associated with similar increases in muscle cross-sectional area after 2-wks (11.3% and 12.4%, respectively) and 4-wks (21.9% and 20.0%, respectively) of training. Although to a lesser magnitude than RT+BFR and RT, BFR alone increased muscle strength (8.6%), but did not elicit muscle hypertrophy. The changes in muscle strength for RT+BFR, RT, and BFR were related to increases in motor unit recruitment and motor unit firing rate. The magnitude of muscle swelling was similar for RT+BFR and RT conditions, but increased to a lesser extent in BFR alone. There were no changes for the control group. These findings indicated that reciprocal forearm flexion-extension muscle actions elicited comparable increases in muscle strength and size with and without a BFR device. These similar adaptations as a result of RT+BFR and RT may be related to the magnitude of muscle swelling. Interestingly, BFR alone elicited small, but significant increases in muscle strength. Collectively, these findings indicated that reciprocal forearm flexion-extension muscle actions elicited favorable adaptations to skeletal muscle and BFR alone may be useful for maintaining muscle function during spaceflight.

GENE EXPRESSION, BIOMARKER, AND FUNCTIONAL ANALYSIS OF SPACE-FLOWN MICE MUSCLE GROUPS REVEALS ANTIOXIDATIVE ENRICHMENT.

Kaitlin Goettsch*, Sean West, and Dhundy (Kiran) Bastola, School of Interdisciplinary Informatics, University of Nebraska at Omaha.

Microgravity exposure increases oxidative stress, leading to muscle atrophy. Antioxidant supplementation has been proposed as a cost-effective and sustainable option to counteract the effects of these effects in space-flown organisms. However, the molecular mechanism of such a treatment is

not well-studied in microgravity environments. In this study, we analyze a dataset of mice flown in a microgravity environment for 30 days. Differential gene expression analysis was utilized to identify genes affected by space-flight. Our own biomarker algorithm was used to delve for further insights into the dataset. Functional analysis was revealed enriched amounts of antioxidant-related genes among the differential expressed. Mechanisms of actions were also intestigated. The increase in only a few genes (10 in one muscle set) shows the potential for targeted treatment to aid in the recovery and sustained flight performed by astronauts and the antioxidant relation hints at a treatment centered in natural drugs.

DIRECTING CELLULAR RADIATION RESPONSE VIA FERROPTOSIS MANIPULATION.

Joseph Carmicheal*, Alexandra Seas, Nolan File, Chi Lin, Sicong Li, Sukhwinder Kaur, and Surinder K. Batra, Department of Biochemistry and Molecular Biology, University of Nebraska Medical Center, Omaha.

Ionizing radiation is one of the limiting factors for the fulfillment of the NASA Human Exploration and Operations Mission Directorate. Long-term implementation of current NASA dietary countermeasures, including current drugs, can lead to intolerable side effects such as nausea, vomiting and hypotension. These will not be feasible for long-term deep space exploration. Improving our understanding of how radiation induces cellular damage is a necessary first step in the development of a novel radio-protectant. A known mechanism by which RT induces cellular damage is through the production of reactive oxygen species. Ferroptosis is and iron-dependent form of cell death triggered via the peroxidation of lipids resulting from exposure to reactive oxygen species (ROS).

This study focused on delineating the contribution of ferroptosis to cellular damage caused by ionizing radiation. We found a primary molecule that can inhibit ferroptotic cell death, GPX4, is upregulated upon exposure to ionizing radiation at the mRNA and protein levels. Further, cells treated with a known inducer of ferroptosis, Erastin, sensitized cells to radiation. The combination of radiation and ferroptotic induction dramatically effected cells ability to proliferate and form colonies, compared to radiation alone, across multiple cell lines. Additionally, radiation was determined to dramatically affect the amount of lethal lipid peroxidation within cells. Ferroptosis inhibitors were then assessed for their ability to abrogate cellular damage upon exposure to ionizing radiation. This study demonstrates that ferroptosis is an underlying mechanism by which cells are damaged by radiation and further, that this pathway can be manipulated to direct the cellular response in a beneficial or detrimental direction.

CORTICAL OSCILLATIONS THAT UNDERLIE VISUAL SELECTIVE ATTENTION.

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Visual selective attention involves focusing on a visual stimulus while disregarding distracting or unrelated visual stimuli. The objective of this investigation was to identify the cortical oscillations associated with visual selective attention in a cohort of neurotypical adolescents (age: 14.2 + 0.4 years). To this end, magnetoencephalographic (MEG) brain imaging was used to quantify the cortical oscillations elicited by an arrow-based Eriksen flanker task. Briefly, participants were presented with a visual stimulus consisting of either a series of flanking arrows that had directions that were all in the same direction (congruent) or where the middle arrow pointed in the opposite direction as the flanking arrows (incongruent), and were instructed to push a button with the second or third digit of the right hand depending on the direction of the middle target arrow. Incongruent flanking arrows were the visual distracting stimuli. Participants were significantly slower during incongruent compared to

congruent trials (incongruent: 721.9 + 25.0 ms; congruent: 660.6 + 25.4 ms; $P < 0.001$). A significant alpha event-related desynchronization (ERD) in the bilateral occipital cortices and bilateral cerebellar cortices was present 250-650 ms after the arrow presentation relative to the baseline period (baseline: -450 to -50 ms; $P < 0.001$). The alpha ERD in the right cerebellum was significantly stronger during the incongruent condition compared to congruent ($P = 0.02$). The strength of the alpha ERD during the incongruent trials was correlated with reaction time, such that those with the strongest ERD had the slowest reaction time ($P = 0.04$, rho = -0.43). These results suggest that neural generators in the cerebellum play a central role in visual attention. We propose that the brain oscillations identified in this study could be utilized as neurological indices of altered visual attention that might occur during long-term space flight.

THE DEVELOPMENT OF A FLUID SHEAR STRESS STREAMER FOR LIVE CELL VIDEO MICROSCOPY.

Travis McCumber*, Edson deOliveira, and Dane Wilson, Department of Genetics, Cell Biology and Anatomy, University of Nebraska Medical Center, Omaha.

Despite strenuous exercise regimens, astronauts aboard the International Space Station (ISS) still lose up to 1% of their bone mass per month. Current crewmembers of the ISS and future astronauts embarking on long duration space voyages face an increased risk of bone fracture. It is well established that mechanical loading is required to maintain bone mass and strength, and that osteocytes act as the primary mechanosensory cell of the skeletal system. The fact that osteocytes are terminally derived and that they reside within a mineralized matrix makes the study of the most abundant cell in bone tissue very difficult. Osteocyte cell lines have been developed for the *in vitro* study of the osteocyte's mechanosensory properties; however, many experimental devices for applying mechanical stimuli do not allow researchers to visualize the *in vitro* strain experienced by the cell and validate how well that strain mimics the strain of osteocytes *in vivo*. The purpose, and ultimately the outcome, of this project was prototype refinement and machining of a transparent, polycarbonate, shear stress streamer. Additionally, streamer function was validated for use during mechanical loading and live cell video microscopy. Design aims were focused on minimizing production cost and the development of the streamer as a multiuse device. The *in vitro* study of osteocytes with respect to mechanical forces is crucial for the promotion of health and wellness for current and future astronauts, and aligns with the primary goals of NASA's iTech initiative which strives to find innovative ideas that address challenges and fill gaps in critical areas identified by NASA as having a potential impact on future exploration.

VISUAL PERTURBATION IMPACTS MUSCLE CO-CONTRACTION WHILE WALKING ON FLAT AND INCLINED TREADMILL.

Jie Hao*, Weihua Li, Yuhang Zhang, and Ka-Chun Siu, Department of Physical Therapy Education, University of Nebraska Medical Center, Omaha.

One of the potential challenges for astronauts during long spaceflight is the loss of muscle strength and the resulting deterioration of locomotor behavior. This deterioration of locomotor behaviors might further endanger astronauts in completing their missions. Extended stays in microgravity environments have been believed to be a major factor in decreasing the maintenance of muscle strength and pattern of muscle activation; however, recent studies found that manipulating visual information could highly influence muscle activation pattern in human standing stability. Specifically, high muscle co-activation (major muscle groups are activated simultaneously) has been found when visual perturbation is provided to subjects in standing. Regular physical exercises in space might not be sufficient to overcome the loss of muscle strength, and to enhance the adaptability to new environments

with different gravities, combining visual manipulation with physical training protocol could be better for astronauts to maximize their training. Therefore, this study investigated how external visual perturbation using virtual optic flow might affect muscle co-activation while walking on flat and inclined treadmill. Twenty healthy adults were instructed to walk on four different treadmill inclinations (0-degree = flat, 3-degree, 6-degree and 9-degree) for two minutes each. Muscle activation was measured by surface electromyography. Two virtual environments (1. Normal optic flow that matched subjects' comfortable walking speed, and 2. Perturbed optic flow with continuous rotating scene) were presented in front of participants during treadmill walking. Our results indicated that higher muscle co-activation was required while walking on a highly tilted treadmill (9-degree inclination). The perturbed optic flow induced much higher muscle co-activation compared with normal optic flow situation. This initial finding was crucial to support that visual manipulation could generate a muscle demanding environment to maximize the training effect. Astronauts could be trained with visual perturbations to enhance their adaptability to new environments with different terrains.

STRUCTURAL INVESTIGATIONS INTO THE CATALYTIC MECHANISM OF HUMAN MANGANESE SUPEROXIDE DISMUTASE USING NEUTRON AND X-RAY CRYSTALLOGRAPHY.

Jahaun Azadmanesh*, William E. Lutz, Kevin L. Weiss, Leighton Coates, and Gloria E. O. Borgstahl, Department of Biochemistry and Molecular Biology, University of Nebraska Medical Center, Omaha.

Superoxide dismutases (SODs) are necessary antioxidant enzymes that protect cells from excessive amounts of reactive oxygen species (ROS). SODs perform their role by converting superoxide, a ROS, into oxygen and hydrogen peroxide by cyclic oxidation and reduction reactions with the active site metal, which is dependent on two proton transfers. Mutations of SODs are linked to cancer, longevity, and neurodegenerative diseases. The crucial bio-protective role of SODs have instigated understanding their catalytic mechanism, especially for application to therapeutic approaches, but remains enigmatic. The difficulty in discerning a mechanism is attributed to limitations in detecting hydrogen positions at the active site. Knowledge of hydrogen positions is paramount to understanding the mechanism because the cyclic redox reactions rely on the coupling of electron transfers to proton transfers. For MnSOD, our group recently proposed a proton relay model, consisting of specific amino acid residues and water molecules, to be the source of protons for proton-coupled electron transfer at the manganese active site. Neutron diffraction of MnSOD was performed to test this catalytic model due to its capacity to visualize hydrogen positions, which has not been possible with the countless X-ray structures published during the last 20 years. Neutron data on crystals where the manganese ions are all either in the trivalent or divalent state reveal several molecules that are protonated and protonation states that differ based on the redox status of the metal. These structures piece together a proton relay for proton-assisted electron transfer where a catalytic mechanism can be deduced.

TESTING QUASAR ACCRETION DISK WIND MODELS USING THE SDSS SPECTRAL DATABASE.

Mason Rhodes* and Jack Gabel, Department of Physics, Creighton University, Omaha.

Radiation driven accretion disk winds are a leading model for the broad absorption lines (BAL) observed in quasars. This investigation provides a crucial test of accretion disk wind models by comparing synthetic absorption spectral profiles to observed BAL parameters. We test how the physical properties of the quasar and the disk wind, such as orientation of the disk, black hole mass, and wind terminal velocity, affect the synthetic profiles. The synthetic spectra are then compared to the observed optical spectra of the Sloan Digital Sky Survey (SDSS) Data Release 12 (DR12) to provide a crucial test of radiation driven disk winds for BALs.

EXPERIMENTAL EVOLUTIONARY INVESTIGATION OF PROTEIN-PROTEIN INTERACTIONS IN LARGE PROTEIN COMPLEXES.

Richard Cassidy*, Zoe Alam, Gabby Beeler, and Ann Cavanaugh, Department of Biology, Creighton University, Omaha.

The ability to undergo cellular division is a vital characteristic of all cellular life on earth. Be it single celled archaea and bacteria or the elaborate multicellular structures found in eukaryotes, cell division is required for successful cellular replication and the creation of progeny. In yeast species, cellular division, particularly the separation of genetic material, is facilitated by a large protein complex called the spindle pole body (SPB). In Saccharomyces cerevisiae the SPB consists of organized repeats of 18 unique proteins. This study explores the evolution of the SPB in two closely related yeast species, S. cerevisiae and Kluyveromyces lactis in order to understand the evolution of individual proteins in a large protein complex without disrupting the overall function of the complex. The study consisted of fluorescently labeling each component of the SPB of K. lactis followed by incorporating the genetic sequence of the tagged protein into the genome of a corresponding S. cerevisiea knockout. We then used confocal microscopy to identify the location and quantity of the protein in the S. cerevisiae construct. The results of this study shed light on the evolution of protein-protein interactions foundational to the successful evolution of early life, as outlined in the Astrobiological Strategy published by NASA.

EMISSION SIGNATURE OF BINARY SELF-LENSING SUPERMASSIVE BLACK HOLES

John O. Dancewicz Helmers* and Jack Gabel, Physics Department, Creighton University, Omaha.

Binary Supermassive Black Hole (SMBH) pairs can form during a galaxy merger event, so it is likely that at least some of the galaxies and active galactic nuclei (AGN) that we observe host a binary pair. These binary pairs may produce a gravitational self-lensing effect that are observable under certain conditions. With the next generation of sky survey projects, such as the Large Synoptic Survey Telescope (LSST), lensing events from binary SMBHs could lead to new information on the inner structure of SMBH and AGN. To understand this phenomenon, I will model a SMBH binary pair and generate its lensing signature.

SOL-GEL PREPARATION OF NOVEL GEO2 AND GEO2-SIO2 NANOPARTICLES FOR USE IN 3D PRINTED OPTICS.

Alexandra Vahle*, Cameron Jayson, and Joel Destino, Department of Chemistry, Creighton University, Omaha.

This project is centered around the production of GeO2-SiO2 sol gels which can be used as an ink for direct-ink-writing (DIW) 3D printing optical quality glass. The 3D-printed glass resulting from this project can be used to make flat, freeform optics. These differ from conventional optics in that they do not rely on the geometry of the lens to guide light. Compared to conventional optics, these introduce the possibility of a smaller system size and a lower wavefront error. Prior work on this project has included working towards improving GeO2-SiO2 particle formation to minimize the size while maximizing the stability of the particles. I have experimented with changing the ratio of water, catalyst, and solvent to the GeO2 precursor, as well as varying the temperature that the reaction is performed at. We also experimented with a processing technique of centrifuging the particles after the shell, resuspending the pellet, and repeating this process to ensure that all of the SiO2 was reacting at the surface of the particles. We found the optimal conditions to be a mole ratio of reagent/ tetraethoxygermane (TEOG) to be 12.5 mol/mol for water, 0 mol/mol for NH3 catalyst, and 112.5 mol/

mol for catalyst for the GeO2 sol, and not processing the GeO2-SiO2 sol. Ongoing studies will seek to develop a method to chemically characterize the core and core-shell particles throughout the stages of nanoparticle growth.

OPTIMIZED SOL-GEL DERIVED SI-BASED NANOPARTICLES FOR USE IN LUMINESCENCE-BASED CHEMICAL SENSING.

Emilia M. Berni*, Peter S. Palencia, and Joel F. Destino, Department of Chemistry, Creighton University, Omaha.

Over the past several decades, there have been numerous reports of chemically tailored Si-based luminescent nanoparticles for use in chemical detection. Many of these protocols require hazardous reagents such as hydrofluoric acid and sodium borohydride, or expensive equipment for vapor-phase synthesis. Recently, there have been reports of greener sol-gel derived luminescent nanoparticles using ascorbic acid and 3-aminopropyltriethoxysilane (APTES). Building off of this work, we report an optimized method for preparing sol-gel derived luminescent nanoparticles with potential use in chemical sensing. Optimization was determined by several factors, namely, emission intensity, shelf-life, and photostability. These particles have been characterized by luminescence spectroscopy, AFM ,and FTIR. Results show that these particles are 4 nm in diameter, with a $\lambda_{ex,max}$ = 400 and $\lambda_{em,max}$= 440. Ongoing studies include surface functionalization through silanization and characterization of these nanoparticles for detecting analytes in solution.

PIPELINE INTO THEORETICAL MATHEMATICS.

Griff Elder*, Jacob Cleveland, Xzavier Herbert, Gage Hoefer, Hudson Hooper, Brad Horner, Ethen Kuether, Andrew Li, Sarah McCarty, and Grant Moles, Department of Mathematics, University of Nebraska at Omaha.

At UNO, we are developing a pipeline that accelerates strong mathematics students through our program. Thus we are opening up opportunities for achievement and research that wouldn't otherwise be available. In this talk, I will discuss this pipeline that for some students begins in high-school, discuss the accompanying collection of on-campus community building activities that simultaneously recruit and support our high achieving students, and discuss some of the outcomes that we have been able to achieve.

AERONAUTICS AND SPACE SCIENCE

SESSION B

COMPUTATIONAL FLUID DYNAMICS ON TRANSITION TO TURBULENCE.

Elizabeth Spaulding* and Jae Sung Park, Department of Mechanical and Materials Engineering, Adam Larios, Department of Mathematics, University of Nebraska - Lincoln.

In fluid dynamics, the transition to turbulence is still not well understood mathematically. While turbulence can be studied experimentally in wind tunnels and simulated numerically, much of the behavior of turbulent and transition flow is unpredictable. Study of turbulent behavior, specifically the turbulent boundary layer, may lead to insight in turbulence control and how to reduce skin friction drag in various engineering applications. For example, in aircraft and ships, skin friction drag makes up a large fraction of the total drag. Reducing skin friction drag would result in reductions in operational cost for airlines and shipping industries, as well as enabling increased speed, range, and endurance.

Much of the literature in turbulent boundary layer theory proposes the presence of organized structures - such as hairpin vortices, turbulent puffs, and traveling waves - which account for most of the energy in turbulent fluctuations. Coherent structures first appear during the transition to turbulence and grow as the flow becomes more turbulent. The presence of structures such as these can give a good indication of when the transition actually begins, though a precise Reynolds number for when transition begins is difficult to acquire. The goal of the current project is to investigate how different conditions affect the transition to turbulence, with a long-term goal of exploring control schemes in wall-bounded turbulent flow. To establish a thorough foundation in the field of fluid dynamics as a whole, laminar and transition to turbulence will be studied, as well as mathematical and computational models for flows at different conditions such as different Reynolds numbers. Ultimately, we will research how changing properties of the flow at the wall will affect flow using equations governing fluid flow.

PROTOTYPING AND VALIDATION OF A MODULAR 6-DOF 3-LEG PARALLEL ROBOT ADAPTABLE FROM AN RRRS TO AN RRPS CONFIGURATION.

Nathan Jensen* and Carl Nelson, Department of Mechanical and Materials Engineering, University of Nebraska – Lincoln.

As parallel-leg robot architectures continue to become more common in both industry application and academic study, advances are being made to improve both their workspace and manipulability. One such development was the recent study of 3-leg parallel architectures with each leg made up of either three rotational joints and a spherical joint (RRRS) or two rotational joints, a prismatic joint, and a spherical joint (RRPS). In both cases, three serial chains mounted around the circumference of a base circle held an end effector platform and controlled its position. This control was accomplished by powering the first two rotational joints, which defined the pitch and yaw of each leg through a differential gear train. A prototype of this parallel robot was constructed with both leg type and leg length as modular parameters. With this, each leg's configuration could be individually selected in order to study the effects of non-uniform leg combinations on the manipulability of the end effector. Analysis was performed in order to study the effect of leg length on the workspace of the robot as well.

DATA ANALYSIS OF TEST ROTORS IN MARTIAN ATMOSPHERIC CONDITIONS.

Nathan Jensen, Department of Mechanical and Materials Engineering, University of Nebraska – Lincoln.

Mars rovers have made some of the most significant discoveries in interplanetary exploration despite operation in a significantly punishing environment. The recent end to the Opportunity rover, for example, highlights both the harsh conditions of the red planet and high volume of science that can be accomplished when a rover can withstand said conditions. The following rover, Curiosity, has shown the need for a technology that could extend the life of future robotic emissaries by acting as an "eye in the sky". This need will be fulfilled by the Mars Helicopter (MH), a drone that will accompany the Mars 2020 rover on its voyage. This leap forward in interplanetary exploration will also be accompanied by its own challenges. The Martian atmosphere is thin and thus not favorable for flight. In addition, the drone must operate autonomously on its first and every subsequent flight. Finally, the Martian atmosphere is difficult to simulate on Earth. Thus, extensive data collection and analysis on flight conditions in the Martian environment must occur before 2020. In order to accomplish this, a set of test rotors roughly approximating those used on the actual MH were set up in the Planetary Aeolian Laboratory (PAL) at NASA Ames Research Center. The test rotors were run at various speeds and atmospheric pressures, and relevant data was collected by a sensor suite installed in the facility. Analysis was performed in order to characterize the rotor performance and understand the fluid mechanics involved. This revealed problems with the testing regime, and subsequent investigations were

made into the facility's capabilities and data acquisition systems. Recommendations were made based on these investigations, so that future testing could be conducted with more efficiency and greater measurement certainty. With this testing, NASA can take one step closer to achieving flight on another planet.

EFFICIENT SUPERSONIC ROCKET UTILIZING STUDENT MANUFACTURED CARBON FIBER TUBES.

Dillon Margritz*, Quinn Brandt, Bricen Margritz, and Joseph Broadway, Department of Mechanical and Materials Engineering, University of Nebraska-Lincoln.

The University of Nebraska-Lincoln Aerospace Club's Rocketry team has been an essential part of many students' educational college experience for many years. Students of a variety of majors are apart of the Rocketry team's annual rocket competitions. This year, the Rocketry team is designing a rocket for NASA's Minnesota Space Grant Consortium's "Midwest High-Power Rocket Competition" in North Branch, Minnesota. The competition this year is to build an efficient supersonic rocket. There will be two different launches for each team. For the first launch every team will be using the same motor which is too small to reach supersonic speeds. Teams will then launch a second time using a motor of their choice to reach as close to Mach 1 without going under. More points are awarded for using as small a motor possible.

In preparation for the competition, the team has utilized multiple simulation programs, such as Open Rocket and SolidWorks, to aid in the design of this year's rocket. After finalizing the rocket design, the team started working on the electronic, payload, and manufacturing portions of the rocket design process with a large focus on developing student manufactured carbon fiber tubes. Carbon fiber tubes have a higher strength to weight ratio which leads to a lighter rocket. They are also expensive. This has lead the team to start developing their own process for making carbon fiber tubes.

COMPUTER SCIENCE TRAINING IN HIGHER EDUCATION USING ROBOTICS.

William A Loring and Bill Spurgeon*, Information Technology Program, Western Nebraska Community College at Scottsbluff.

Computer Science curriculums have traditionally used creating desktop applications as the main focus of learning activities. Using off the shelf robotics kits provides a hands-on approach and shows the students their "code in motion." The WNCC Computer Science curriculum starts in the first year with Intro to Robotics which uses an off the shelf Arduino based robot. This robot can be programmed by a mobile device, Scratch based block environment, and Arduino C. Arduino C is very similar to Java, which makes C a good programming stepping-stone to Java. The next step in adding robotics to the curriculum is to add a more advanced robot, the GoPiGo to the curriculum. This will be integrated into the second year Computer Science track. The Raspberry Pi based GiPiGo can be programmed in multiple languages, Python, C, Java, and others, making the Pi a versatile platform for learning and NASA fellowship projects. This hands-on approach of seeing the results of their code in the physical world enables a faster feedback learning cycle and better transfer of knowledge. Students enjoy working with the robots; having fun enables better learning.

NODE BASED PATHFINDING AND SATELLITE AUTONOMOUS NAVIGATION USING THE GO PI GO RASPBERRY PI ROBOT.

Daniel Smith* and William Loring, Computer Science, Western Nebraska Community College, Scottsbluff.

This research project was designed to explore the use of artificial intelligence for autonomous

navigation using the Go Pi Go robot kit. The research project used the Python programming language to create the programs used by the robot. This project sought to specifically allow the robot to navigate through node based pathfinding (specifically, Dijkstra's algorithm). Node based pathfinding accepts points similar to a coordinate graph. The interconnected points map out a mesh of the environment. Using these points, the algorithm calculates the shortest distance to each point, and finds the shortest path. The project implemented the algorithm by manual input of simulated points through a python program, and outputs the correct path. The goal is to have the robot be able to read the path and navigate an area autonomously. The real world application and future use of this research would be to implement satellite readings using LIDAR (Light Detection and Ranging) to collect data. The current program created in this research accepts a list of different points with coordinates. These coordinates could be replaced by Latitude, Longitude, and Altitude readings. A satellite could read an area from a small section of land, to an entire planet, and a robot could navigate a scanned area efficiently. The current implementation of the algorithm is two dimensional. Altitude could be implemented to automatically connect points that would be navigateable through slope calculations. It would be possible to have autonomous navigation across any pre-read areas.

ENHANCING INTRODUCTORY CLASSES WITH HANDS ON PROJECTS.

Hunter Nelson*, William Spurgeon, and Scott Schaub, Mathematics and Science, Western Nebraska Community College, Scottsbluff.

The goal of the first semester was to learn the ANSYS simulation software in order to create a project that could be used for the Introduction to Engineering class. After trying various free software programs from the ANSYS website, we ended up working with the ANSYS AIM Student version. We chose this program because it has guided simulations that make navigating and running simulations easier. There are YouTube videos that illustrate the different types of simulations the software has. This helps you learn the software well enough to develop a simulation. We used the heat transfer analysis for a project, and made instructions that give a detailed description of how to run the simulation. It also gives the students the ability to change some of the variables in the simulation to see how that effects results. I also built several Arduino kits for the Intro to Engineering class. These kits are to give students hands on experience with programming and interfacing with electronic sensors. The second semester I worked with MATLAB and the Raspberry Pi for the Programming and Problem solving class. I made sure that the Raspberry Pi was able to make a connection with MATLAB in a wireless environment. We are refining and developing projects for homework that would be helpful for this class.

COLLEGE OF SAINT MARY SCIENCE ENRICHMENT WORKSHOP SERIES: A FOCUS ON ELEMENTARY SCIENCE EDUCATORS.

Amanda Roe*, Department of Biology, Ganesh Naik, Department of Chemistry, Kelly Murphy and Mark Sand, Department of Mathematics 4Math Program, College of Saint Mary, Nancy Thornblad and Dayna Derichs, Omaha Public Schools, Omaha.

Generating elementary students' interest in science is arguably best achieved by supporting and educating elementary teachers. However, elementary teachers are primarily trained as generalists, and research has shown they often lack confidence teaching science subjects. The College of Saint Mary has developed a series of workshops for elementary science teachers that are a combination of lectures, hands-on activities, and education pedagogy. The combination of content and pedagogy provides both foundational knowledge and practical skills to increase teachers' self-efficacy—a combination that has been proven effective in academic studies. Two workshops are offered: Physics and Engineering and Math and Chemistry. Each workshop is taught by two CSM science faculty and one education faculty. Class sizes are limited to 20 teachers and teachers are chosen based on an

application process that gives preference to teachers from high-need schools. Workshops are offered once a month for six months and each is 5 hours long. After successful completion of the series, teachers receive $250 for classroom materials and two graduate credits from College of Saint Mary. Teacher confidence is measured using pre- and post-survey questions. The pre- and post- questions are the same, with Likert scale response items attached to statements that operationalize each outcome or objective. Teachers take the pre-survey before programming begins in October, and then take the post-survey when programming ends in April. Mean scores of participants' responses are determined for each survey, and are then aggregated by outcome/objective and analyzed for statistically significant changes. Additionally, open-ended response questions are included on the post-survey to gather richer, qualitative data about teachers' experiences with the program. Furthermore, we have added more specific, quantifiable questions to our post-survey to better understand the extent to which teachers apply the material they have learned in the workshops to their work in the classroom.

IN-VITRO ANTICANCER EFFECT OF CURCUMIN, QUERCETIN AND THEIR COMBINATION ON MELANOMA CELL LINES.

Farrah Soll* and Dr. Dunesh Kumari, Department of Chemistry, College of Saint Mary, Tyler Moore, Department of Biology, Bellevue University, Bellevue.

Spaceflight increases oxidative stress in astronauts with severity depending on the duration of space travel. Increased oxidative stress, caused by the presence of free radicals, is associated with disease and a variety of chronic and degenerative health conditions. Phytochemicals, curcumin, and quercetin have known anti-cancer, anti-inflammatory, and anti-angiogenesis properties due to their ability to fight the presence of free radicals in the body. Curcumin, a major component of Curcuma longa rhizome, is found in turmeric. Quercetin, a dietary flavonoid, is found in fruits and vegetables. Curcumin and quercetin are poorly soluble in water and therefore, have limited bioavailability. The present study aimed to investigate the effects of curcumin, quercetin and their formulations (in combination and separately) dissolved in Dimethyl sulfoxide (DMSO) solution on the cytotoxicity of B16 mouse melanoma cells. Colorimetric, luminescent, and microscopy methods were used to quantify cell viability. Furthermore, flow cytometry was used to identify the mechanism changes in cell viability. Specifically, dual staining for phosphatidylserine and cell permeability were used to study apoptosis and necrosis in treated cells. Curcumin was found to induce apoptosis at or above 50 mg/mL in B16 melanoma cells. Etoposide, a chemotherapeutic medication, was used as a positive control in the study. Curcumin has shown promise to be a more effective anti-cancer medication than Etoposide. Additionally, curcumin is non-toxic to non-cancerous cells. These findings contribute to NASA's mission to keep astronauts safe and healthy by developing a preventative treatment against oxidative stress that can be used during and after space travel.

WOMEN IN AVIATION: WHERE ARE THEY?

Rebecca Lutte, Aviation Institute, University of Nebraska at Omaha.

The global aviation industry is facing an unprecedented challenge in meeting the hiring needs of aviation professionals in the industry workforce. It is essential that outreach to underrepresented groups is a part of the strategy to address meeting these personnel needs. In order to more efficiently and effectively enhance outreach to the underrepresented group of women in aviation, we first need to identify the numbers of women throughout the field to gain a better understanding of gender gaps in employment. The purpose of this study is to develop a workforce report which presents the numbers of women employed in a variety of aviation fields. The data show that that women make up less than 10% of many occupations in aviation. Women represent just 5% of total airline pilots and only 1.5% of airline captains are women. In the field of aviation maintenance, 1.7% of the workforce are women.

Approximately 7.8% of aerospace engineers are women. In airport management, 16.6% of accredited airport managers are women. These figures are just a sample of the data points to be reported in the workforce study. Other areas explored include women in leadership positions such as CEOs and CFOs. The study will provide information that will assist in targeting recruiting and retention efforts in order to enhance the ability to meet the growing needs for the next generation of aviation professionals.

HEAVY METAL AND NITRATE CONCENTRATIONS IN GROUND AND SURFACE WATER NEAR CRAWFORD NEBRASKA.

Isaac Langan*, Mike Leite, and Jennifer Balmat, Department of Physical Science, Chadron State College, Dr. Dana Richter-Egger, Department of Chemistry, University of Nebraska at Omaha.

Private wells are a common drinking water source for people in rural areas. The water is not required to be regularly tested and can contain ion levels that are dangerous for human consumption. To learn more about water quality in northwestern Nebraska, surface and ground water samples were collected from private land in Dawes County. The samples were sourced from the aquifers in the Whiter River Group and the alluvium of the White River. A total of 50 water samples were collected in October of 2018 and analyzed using a nitrate specific electrode, at Chadron State College, and induction coupled plasma mass spectrometry (ICPMS), at the University of Nebraska at Omaha, to find the concentrations of 17 potentially harmful ions. The samples were divided into two groups. Group 1 was collected within 1.25 miles of the White River, group 2 was collect between 5 and 15 miles southeast of the river. Within in both groups, wells were found that had levels of arsenic, uranium and nitrates which were higher than the EPA's maximum contaminant levels. The average concentrations of arsenic, uranium and nitrates were statistically higher in group 1 when compared to group 2 ($p<0.05$). The White River parallels faults which could allow for water mixing between deep and shallow aquifers. The water mixing could be one cause of the abnormally high heavy metal concentrations within ground water near the White River.

IDENTIFYING EARTH ANALOGUE SITES TO TEST AND ASSESS THE MARS HELICOPTER'S ABILITY TO CAPTURE IMAGES OF ASTROBIOLOGICAL TARGETS DURING THE MARS 2020 MISSION.

Jessica Rowshandel, Physical and Life Sciences Department, Chadron State College, Chadron.

For the first time in history, a helicopter will be part of a space mission. The Mars Helicopter, an unmanned aerial vehicle (UAV, or drone), will ride along with the Mars 2020 Rover. The UAV is able to collect more detailed photogrammetric data than Mars orbiters. Orbiters provide a large-scale view of the planet, while rovers provide us with a small-scale view of their environments. With a UAV, however, collecting data at an intermediate scale is possible. This includes eye-level images of geologic features like faults, fractures, surface texture, color, and grain size larger than sand. This data collection is integral to meeting the mission's astrobiological science objectives. In order to help the UAV succeed on Mars, testing is required on Earth at an appropriate analogue site in order to obtain a better understanding of what features it can clearly capture. This includes an assessment of its ability to capture images that would help identify astrobiological targets, the accuracy of its photogrammetry, and ways to improve this accuracy. For increased success at capturing such data, it is recommended that a UAV be equipped with a spectrometer in future missions.

Finding a landing site on Mars required five years of evaluation of over 60 possible sites. Therefore, there is much data available on how and why these sites were evaluated. An effective way to apply this data is to utilize and adapt the already-existing rubric and science goals used to pinpoint

Jezero Crater as the mission's landing site. Locations within Toadstool Geologic Park in Nebraska and the Mojave Desert in California have been evaluated using an appropriately modified version of this rubric and science criteria. They were chosen as analogues both for researchers' ability to access the sites and meeting much of the same rubric criteria as Jezero Crater.

COMPARISON OF PLANT GROWTH IN THREE MARTIAN SOIL SIMULANTS.

Marc Albrecht* and Jackson Barnes, Department of Biology, University of Nebraska at Kearney.

This study compares the growth of rye in three different Martian simulant soils. Martian 'soil' is regolith and previous work has shown that different particle of the regolith causes significantly different growth. Here we compare three different formulations of Martian soil regolith in terms of the growth of rye grass. One simulant is from Orbitec LLC, the other two simulants are from Martian Gardens MMS-1 and MMS-2. The growth in each simulant were compared to each other and a potting soil control. We found significant difference between the soil simulant types. The chemical differences between the Martian regolith types will be discussed. We also experimented with 3-D printed perforated tubes placed in the plant containers to increase gas exchange and water movement. The tubes appeared to function as intended but there was not a significant increase in growth.

CORTICAL PROCESSING OF SOMATOSENSORY INFORMATION IS REDUCED WHILE PERFORMING A MOTOR TASK.

Michael P. Trevarrow*, James E. Gehringer, Tony W. Wilson, and Max J. Kurz, Department of Physical Therapy and Center for Magnetoencephalography, University of Nebraska at Omaha.

It has been well-established that a broad band synchronization of neural activity occurs within the somatosensory cortices in response to peripheral stimulation. However, less is known about how this somatosensory information is processed while simultaneously performing motor actions. In the current study, magnetoencephalography (MEG) was used to assess the power of the relative and spontaneous somatosensory cortical oscillations as a cohort of adolescents underwent the following experimental conditions: 1) passive tibial nerve stimulation while sitting quietly and 2) performing a target matching task while undergoing stimulation. Beamforming methods were then used to image the oscillatory source power changes across the entire brain volume. From these brain images, we extracted the peak voxel of activity and compared pseudo-t values at that voxel between the active and passive conditions. Subsequently, we extracted the neural time course of the peak voxel (cube of tissue) in the somatosensory cortices and used the average of the absolute cortical activity during the baseline period to quantify the spontaneous cortical oscillations. For both conditions, there was an early (0-125 ms) increase in power of oscillatory activity in the postcentral gyrus spanning from 4 – 80Hz. The strength of the cortical oscillations within the alpha-beta band (8-30 Hz) was significantly stronger during the passive condition (Passive = 6.82 ± 1.53 pseudo-t, Active = 2.87 ± 0.92 pseudo-t, $p = 0.02$), and the power of the spontaneous activity in the passive condition was significantly increased (Passive = 252.80 ± 47.92 nA2, Active = 172.29 ± 28.51 nA2, $p = 0.014$). We suggest that the reduced power indicates that the peripheral afferent somatosensory information is gated while performing a motor task. This information is critical to the understanding of normal sensorimotor processing, and deviations may provide a unique neurologic index for identifying aberrations in brain activity after astronauts return from space.

PERCEPTION IN SPACE.

Kyle Brozek*, Steven Belcher, Prithviraj Dasgupta, Mukul Mukherjee, Department of Biomechanics, Computer Science Department, University of Nebraska at Omaha.

One of the most prominent and immediate issues faced by astronauts returning from long duration spaceflights are those that are encountered during balance and mobility-related tasks. These issues include stamping gait, drifting off the intended path, abnormally increased step length variability and base of support, speed changes while turning around corners, and changes in muscle activation patterns and their variability. One major reason for these deficits is the sensorimotor recalibration that occurs during long duration space flights. This leads to an altered perception of joint position during static and dynamic tasks. Such altered perceptions can consequently lead to major deficits in performing tasks in outer space, and even after returning to earth. Currently, there are no objective methods to detect such altered joint perceptions while performing dynamic tasks such as walking in microgravity. To address this issue, we are developing a modular, self-reconfigurable robot (MORS) which is fitted with internal measurement units (IMU) that can inform the system about position, velocity, acceleration, and joint rotation data. We are currently performing data collection with a lab-designed position sensor while simultaneously collecting data from a gold-standard machine to confirm the accuracy of the data. Data collection is being performed with or without vision, for different directions (flexion/extension/rotation) and different joints (e.g. elbow, knee, or ankle) while human perception is recorded through the press of a button whenever a predetermined angle is perceived to have been reached during joint motion. Collecting a large number of trials and samples will then inform our machine learning algorithm to enable the prediction of joint movement perception.

SUPERVISED AND UNSUPERVISED MACHINE LEARNING TECHNIQUES FOR PREDICTING MOBILITY-RELATED PERCEPTION ERRORS IN ASTRONAUTS.

Steven Belcher* and Prithviraj Dasgupta, Computer Science Department, Kyle Brozek and Mukul Mukherjee, Department of Biomechanics, University of Nebraska at Omaha.

A major problem encountered by astronauts returning from long durations in microgravity environments in outer space is their inability to perform normal mobility-related functions for prolonged periods. The major reason for this problem is the recalibration of the sensorimotor system in microgravity environments, which leads to an altered perception of joint positions. Consequently, astronauts have reported experiencing problems including muscle fatigue, inability to correctly perceive ambient distance and space, and incorrectly timing arm and leg movements in outer space and even after returning to earth. Currently, there are no objective methods to detect such altered joint perceptions while performing dynamic tasks, such as walking, specifically in space. To address this problem, we are developing a modular self-reconfigurable robot called the Modular Robotics Suit (MORS) that is fitted with position sensors, and, once attached to the leg and/or arm joints of a person, could automatically detect position change of the joints during different tasks. In this work, we present our research on using machine learning (ML) techniques to analyze time-series mobility data collected from humans while performing simple mobility tasks such as flexing arms or legs. Our ML technique then automatically predicts if there were any space-time perception errors by the human while performing the mobility task. We present results comparing the efficiency and accuracy of different ML techniques including convolutional networks, self-ensembling networks and Support Vector Machines. Initial results on a small dataset have been promising, showing good prediction accuracy with reasonably small loss. The next step of our research will be to test the accuracy of the ML techniques when joint movements are performed in more stressful conditions – e.g., against a load, under fatigue, etc., to understand the effects of sensorimotor recalibration on perception of body position, and, use this knowledge to target appropriate counter-measures to overcome this problem.

BIMANUAL COORDIATION ASSESSMENT USING PROSTHETIC SIMULATORS

Christopher Copeland*, James Pierce, Keaton Young, and Jorge Zuniga, Department of Biomechanics, University of Nebraska at Omaha.

There were a total of 1.6 million people living with loss of a limb in 2005. This number is projected to double to 3.6 million by 2050 [1]. While prosthetics aim to enhance the function of these individuals, it is estimated that 45% of pediatric prosthetic users reject their prosthesis [2]. The literature which describes the motor control mechanisms of prosthetic use is sparse and often low-powered due to inadequate number of subjects. However, prosthetic simulators may be a solution to chronically low-powered prosthetic studies by serving as functional homologues. The purpose of this investigation was to determine the efficacy of prosthetic simulators by examining movement asynchronies during a bimanual coordination task in prosthetic use in upper limb deficient (ULD) children compared to typically developing (TD) children. Children with upper limb deficiencies (n = 5) with body powered prosthetic devices and typically developing age and sex matched children (n = 5) performed bimanual reaching tasks. The typically developing group performed these tasks both with (TD-Simulator) on their non-preferred hand and without (TD-Control) using the prosthetic simulator. Each subject started from a standardized position and reached forward to grasp an instrumented tray, move a handle to a ledge, and return their hands to the standardized resting position. Movement times were noted for each component of the task. Two-way analysis of variance yielded a significant main effect of limb condition (ULD, simulator, and control). Furthermore, bimanual coordination between groups for each task was not significantly different. However, trends from analysis suggest that bimanual asynchrony is present in the ULD group, as they often lead with their preferred hand. 1. K. Ziegler-Graham, et al. Arch. Phys. Med. Rehabil., 89, 3, 422–429, 2008; 2. E. A. Biddiss Prosthet. Orthot. Int., 31, 3, 236–257, 2007.

APPLICATIONS OF ANTIMICROBIAL 3D PRINTING MATERIALS IN SPACE.

Michael Thompson* and Jorge Zuniga, Department of Biomechanics, University of Nebraska at Omaha.

Bacterial threats pose major challenges in human spaceflight. Astronauts experience immune dysregulations in prolonged space missions, increasing their susceptibility to infection. Astronauts aboard the International Space Station produced the first medical devices in space using the additive manufacturing technology using a zero-gravity 3D printer. The production of 3D printed medical devices in space aims to eliminate the risk of related supply chain and logistical issues. However, the need for bacterial countermeasures in flight persists. The use of antibacterial 3D printing filament to manufacture medical devices has a promising potential as a preventive countermeasure to bacterial risk during spaceflights. PLACTIVETM is an antibacterial 3D printing filament that has shown to be up to 99.99% effective against *Staphylococcus aureus* and *Escherichia coli*. Applications include 3D printed antimicrobial orthoses, open wound closure, and surgical instruments. Antimicrobial additive manufacturing can improve quality of life in space and on Earth.

3D PROSTHETICS EFFECTS ON STANDING POSTURE IN UNILATERAL UPPER LIMB DEFICIENT CHILDREN.

Keaton Young, Department of Biomechanics, University of Nebraska at Omaha, NE 68182.

INTRODUCTION: Upper Limb Reduction Deficiency (ULD) is a congenital disability that affects the upper limb, which the Center for Disease Control and Prevention estimates that nearly 1,500 babies are born with ULD in the United States yearly [1], [2]. Recent research indicates that 64% of an adult population with ULD experience chronic pain in the thoracic region of the upper body, which

is primarily associated in the upper back and neck [3]. Prior research has focused on functional treatment of the upper limbs but has lacked observance of the effects that prosthetics and limb loss incur to the trunk. Therefore, the purpose of this study is to examine the acute effects of 3D prosthetics on standing trunk posture. METHODS: Ten children 3-18 years of age were recruited (5 = ULD, 5 = Control) for participation in this study. Body-powered prosthetic devices were designed using computer-aided design software and fabricated using 3D printers that were utilized by both groups. Participants stood without a prosthetic in Condition 1 (C1) and with a prosthetic in Condition 2 (C2). Motion and force capture was used to observe trunk rotation in multiple planes and center of pressure. RESULTS AND DISCUSSION: Lateral bending range of motion (ROM) was slightly greater in C2 compared to C1. Greater flexion/extension was recorded in C2 compared to C1 in lower segments of the back until the L1 vertebrae. No significant differences in COP in the Anterior-Posterior (AP) or Medio-Lateral (ML) directions have been observed in the current data set. The presented data indicate that the presence of a prosthetic device causes slightly greater movement to occur in multiple segments of the trunk in both the frontal and sagittal planes with little effect on COP in the AP or ML directions. REFERENCES: [1] Rosano et al, Am. J. Med. Gent. 2000. [2] M. A. Canfield et al, Birth Defects Res. Part A - Clin. Mol. Teratol. 2006. [3] S. G. Postema, C. K. van der Sluis, K. Waldenlöv, L. M. Norling Hermansson, PLoS One. 2012.

DEVELOPMENT OF LOW-COST 3D PRINTED ANATOMICAL MODELS FOR PRE-SURGICAL PLANNING AND EDUCATION.

David Salazar*, Justin Cramer, Nicholas Markin, Gabe Linke, and Jorge Zuniga, Department of Biomechanics, University of Nebraska Omaha, Omaha.

3D printing has played a crucial role within the medical field, with one of the most recent applications being in the development of patient specific models to assist with pre-operative planning [1]. These models can be rapidly developed using existing computed tomography (CT) or magnetic resonance imaging (MRI) data sets normally collected by hospitals. The use of these tangible 3D models is useful in conceptualizing complex anatomy that can be hard to see on 2D images. This can prove especially assistive for orthopedic surgery, where the anatomy can be very complex in both healthy and pathological instances [2]. In this study, anatomical models of patient specific data reflective of various acetabular fractures were developed using traditional hospital methods (proprietary segmentation software and high-end 3D printers) as well as low-cost alternative methods (open source software and low-cost 3D printers) to observe differences between the two methodologies. Measurements of various pathological, such as fracture fragments, and anatomical landmarks were taken in order to measure print precision in comparison to the original CT data collected by the hospitals. Additionally, a standardized 10-question survey was given to medical professionals in order to assess different aspects of the produced model such as accuracy and pathological representation [3]. 1. Al Ali A, et al. Eplasty 15, e37, 2015. 2. Gadia A, et al. Asian Spine Journal 12(2), 365-371, 2018. 3. Bagaria V, et al. Injury, 48, 2501-2508, 2017.

AERONAUTICS AND SPACE SCIENCE

POSTER SESSION

THE VIRULENCE OF PYTHIUM IRREGULARE AND PYTHIUM ULTIMUM AT VARYING DEGREES OF TEMPERATURE.

Alyssa Anderson* and Phyllis Higley, College of Saint Mary, Omaha.

Pythium is a plant pathogen that has the ability to harm a variety of agricultural species. Its

pathogenicity can cause simple symptoms such as discoloration and stunting of roots, and more severe conditions such as root rot, damping off, or death of the plant. This study focused on the pathogenicity and virulence of Pythium under varying temperature. This study included four Pythium isolates; two isolates were Pythium ultimum, and two isolates were Pythium irregulare. The effects of these isolates were tested against four host species of plants (alfalfa, basil, kale and radish) at four controlled temperatures, 13°C, 18°C, 30°C, and 35°C. The results showed that both species of Pythium had greater virulence at lower temperatures than high temperatures. The isolate-host combinations that grew in the 35°C showed no disease symptoms. At 35°C the Pythium isolates grew too slowly to affect the plant hosts. However, the isolates had varying degrees of virulence with the plant hosts at the other temperatures.

COLLEGE OF SAINT MARY ELEMENTARY OUTREACH PROGRAM 2018-2019.

Elisabeth White, Chloe Jensen, and Jennifer Grove*, Department of Biology, College of Saint Mary, Omaha.

The College of Saint Mary (CSM) Elementary Outreach Program provides hands on activities and interactive learning in math and science topics to elementary students (grades K-5) in the Omaha and surrounding areas. This service is provided by CSM students who work in groups to teach the lessons according to Nebraska state science standards, as well as incorporating a fun, hands-on activity to demonstrate and enforce the material. The program works to reach as many students in the Omaha community as possible each year, as well as utilize student volunteers from all majors and backgrounds at CSM. So far, a total of 916 students were serviced in the Omaha area through the Outreach program since September of 2018. The program reached 383 students in grades K-2 and 533 students in grades 3-5 in the fall semester. Through February of 2019, a total of 332 students have already been served with 70 in grades K-2 and 262 students in grades 3-5. This results in a total of 1,248 students, from 11 different Omaha area schools, that have participated in the CSM Elementary Outreach Program for the 2018-2019 academic year, with more to come in the remaining months of the school year. The program has been found to promote a growing career path, interest in the STEM subjects, and a chance to spark new interests in elementary students. Many area elementary schools do not have the resources to incorporate such activities and this program allows children to experience projects that they can often take home and continue researching. CSM student volunteers from all backgrounds give positive feedback on their experiences and enjoy the opportunity to volunteer their time to benefit the community and seeing how much these activities are enjoyed by all the children involved.

EFFECTS OF TEMPERATURE AND PLANT HOST ON THE VIRULENCE OF ISOLATES OF PYTHIUM IRREGULAR AND PYTHIUM ULTIMUM.

Emma Turner* and Phyllis Higley, Department of Biology, College of Saint Mary, Omaha.

Pythium is a wide-spread oomycete that causes damping off (seedling collapse), root rot, and stunted growth in hundreds of plant species. Pythium disease can be a particular problem in greenhouse- and hydroponically-grown plants, and could, therefore, be a limitation to food production on the International Space Station. Environmental conditions can significantly impact disease severity. This study looked at the effect of two temperatures (18 C and 30 C) on the virulence of two species of Pythium (P. irregular and P. ultimum) in alfalfa, strawberry, and lettuce. The P. irregulare isolates were isolated from alfalfa and Arabidopsis. The P. ultimum isolates were isolated from strawberry and an unrecorded host. Seedlings germinated on water agar and soil-grown plants were evaluated. Although the literature indicates that P. irregular and P. ultimum have optimum temperatures of 15-22.5 C, we did not see a trend of greater virulence at the cooler temperature tested. Symptoms were most prevalent in strawberry regardless of temperature or isolate treatment.

AMORPHOUS FORMULATION OF POORLY SOLUBLE CURCUMIN AND PIPERINE: CHARACTERIZATION AND *IN VITRO* STUDIES.

Anne Wilson* and Dunesh Kumari, Department of Chemistry, College of Saint Mary, Deepal Vora, School of Pharmacy, Creighton University, Omaha.

Curcumin and Piperine synergistically have been shown though numerous studies to exhibit antioxidant effects within the cells, which can be beneficial to combat cancer of various types. NASA is interested in research of this nature due to the increased exposure to radiation as a result of space exploration. However, due to limited solubility, curcumin and piperine have very low bioavailability, limiting the therapeutic anti-oxidant potential. The present study is focused on the preparation and characterization of the formulations of curcumin and piperine to enhance the drug solubility and stability. Different ratios of curcumin and piperine incorporated in polymer matrix [Hydroxypropyl-β-cyclodextrin (HPβ-CD), Polyvinylpyrrolidone (PVP),] were prepared and characterized using Infrared spectroscopy (IR), X-ray Diffraction (XRD) and Differential Scanning Calorimeter (DSC). PVP was found to be most suitable polymer for amorphous complexes for curcumin- piperine formulations. Solubility studies were carried out in aqueous solutions at room temperatures using UV method as analytical tool for determining the concentration of compounds. Continuous release of the drug from the complexes was observed. Stability of amorphous complexes were evaluated over a period of 6 months at room temperature. We further, investigated the cellular localization of pure drugs and their formulations into MDCK (Madin-Darby Canine Kidney) cell lines using a confocal microscope. Preliminary results show a positive intake of the curcumin whereas due to low EC 50 value the piperine fluorescence is overshadowed by curcumin making it difficult to determine its uptake. Further, experimentation is being carried out.

DEVELOPMENT OF CHEMICALLY MODIFIED LUMINESCENT SILICON NANOSTRUCTURES WITH POTENTIAL USE IN THE DETECTION OF ABIOGENIC COMPOUNDS.

Peter S. Palencia, Emilia M. Berni, and Joel F. Destino*, Department of Chemistry, Creighton University, Omaha.

It is known that polycyclic aromatic hydrocarbons compounds (or PAHs) are the most common and abundant polyatomic molecules in the observable universe. These molecules are also classified as abiogenic, meaning, critical to the origin of life. In 2020, NASA will launch a mass spectrometer based instrument, the Mars Organic Molecule Analyzer (MOMA), on board the ExoMars for an astrobiology mission. Various biosignatures will be studied, but those of PAHs are particularly relevant because of their long term persistence and resistance to oxidative and photochemical degradation. In this presentation we report preliminary research in the development of new photoluminescent (PL) silicon nanoparticle (Si-NP) based materials with the long term goal of tailoring their chemistry to provide selective and sensitive detection of PAHs. It should also be noted that while PAHs themselves are luminescent, they are likely undetectable at low concentrations. Furthermore, this method is appealing because, should it be viable, it could be engineered into a device that is more compact with simpler data analysis than that of MOMA. Chemically tailored PL Si-NPs have been used in chemical detection with applications ranging from *in vivo* disease diagnostics to sub-ppm gas sensing. In this presentation, we report an optimized synthesis for the production of our core Si-NPs and preliminary characterization including UV-vis absorbance spectra, PL emission spectra, and particle size and morphology measurements. We will also discuss ongoing research to functionalize Si-NPs and determine their selectivity and sensitivity for PAHs.

USING DRONE IMAGERY TO EVALUATE LANDSCAPE-BASED VARIATION IN VEGETATION OF THE NEBRASKA SANDHILLS.

Alexander Larsen and Mary Ann Vinton*, Environmental Science Program and Department of Biology, Creighton University, Omaha.

Studies using drone imagery for rapid and high-resolution remote sensing have been increasingly prevalent. Despite the volume of studies using these unmanned aerial vehicles (UAVs), there is a lack of standardization in the methods of these studies. Therefore, the goals of this study were to calculate vegetation cover using UAV imagery, evaluate the effectiveness of two vegetation indices, and quantify the change in vegetation cover along an upland-lowland gradient. The study site for this project was the Nebraska Sandhills, an expansive grassland region consisting of grass-stabilized sand dunes and interlaying wetland meadows. We used two vegetation indices, Green Ratio (% Green) and GRVI (the normalized green red difference). A handheld, PAR (photosynthetically active radiation) ceptometer as well as a visual estimate were used to measure LAI and vegetation cover in field plots. Following the plot measurements, the drone was used to capture overhead images. We used the software, GRASS GIS, to calculate both vegetation indices. Finally, we analyzed the correlations between UAV and field plot data. Results indicate that the Green Ratio greatly outperformed GRVI in this grassland environment. We found that vegetation cover increased from upland to lowland as expected, however, the standard deviation did so as well, which was unexpected. Overall, our results indicate that normal color drone imagery may be a usable, low-cost option for remote sensing applications; however, the effectiveness would likely be improved with the addition of a near infrared sensor.

ENVIRONMENTAL MONITORING THROUGH NATIVE PRAIRIE RESTORATION.

Anthony Warrior*, Lorraine Smith*, Alexander White, Gabriela Medina, Inessa Lyons, Susan Morris, Clorice Denny, Marcus Redwing, and Hank Miller, Department of Natural Resources, Nebraska Indian Community College, Niobrara.

This long-term research project compares local weather data from our Nebraska Indian Community College (NICC) Santee weather station with biological markers from our Santee Native Prairie Restoration Project. Both are located on our Santee campus and our four research plots occupy thirteen of those acres. The biological markers come from: satellite images of our research site, ground level photos of the four plots, plant inventories from all four plots, and soil samples from each of the four plots. Our native prairie restoration management techniques consist of three consecutive years of spring mowing followed by a spring burning on the fourth year. This management regime will be included in our analysis and correlated with all other data. We hope to gain knowledge about how weather and management techniques influences biodiversity and successional changes in our prairie restoration plots.

DEVELOPMENT OF A DEPLOYABLE AND RETRACTABLE BOOM FOR SPACE PLATFORMS.

Renick Wilson*, Ryan Green, Tom Faulconer, and Zoe Marzouk, College of Engineering, Mechanical and Materials Engineering, University of Nebraska-Lincoln.

Sounding rockets carry scientific payloads above the Earth allowing observation in microgravity. Optimal instrument operation in sub-orbital research 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 SHEAth-based Rollable LEnticular-Shaped and low-Stiction (SHEARLESS) boom has been designed for this application, and will deploy a small sensor

suite outside of the vehicle. This payload will launch on a Terrier Improved sounding rocket. At apogee the boom will deploy, dwell, retract, and lock in place in microgravity. To verify success, video and sensor data will be stored on board as well as be telemetered. Supported by Langley Research Center, Wallops Flight Facility, and the University of Nebraska-Lincoln.

ASSESSMENT OF 3D PRINTED FINGER PROSTHESES: A COMPARATIVE CASE STUDY.

Claudia Cortes Reyes*, Roberto Saavedra, Keaton Young & Jorge Zuniga, Department of Biomechanics, University of Nebraska at Omaha.

In 2005, 1.6 million upper limb amputations were recorded; this number is expected to reach 3.6 million by 2050. Among these, finger loss is the most common [1]. Finger amputation impacts daily function, coordination and quality of life[2]. Traditional prosthetic fabrication spans multiple days. However, additive manufacturing poses as an accelerated alternative method. The purpose of this study is to describe the development of a transitional 3D printed finger prosthesis and define the qualitative and functional characteristics when compared to a commercially available prosthesis. The subject had an acquired traumatic amputation of the index finger and attained the MCP-DriverTM finger prosthesis from NAKED Prosthetics Inc. prior to study participation. The subject was also fitted with a 3D printed prosthetic. The Box and Block Test (BBT), was performed to provide a functional measure of unilateral gross manual dexterity. The average number of blocks moved did not differ between prostheses Additionally, the subject completed two satisfaction surveys, Quebec User Evaluation of Satisfaction with Assistive Technology (QUEST 2.0) and Upper Extremity Functional Status (OPUS)[3]. Results of the QUEST 2.0 device satisfactory survey suggested that the 3D printed finger prosthesis scored slightly higher (3.3 ± 1.2), as compared to the MCP-DriverTM (2.5 ± 0.5). Limitations in the OPUS revealed only 5 of 28 questions were applicable to the 3D printed prosthesis, where 27 of the 28 were applicable to the MCP-DriverTM. Outcomes from functional and satisfactory testing established potential in transitional 3D printed prostheses.

EFFICACY OF ASSISTIVE DEVICES PRODUCED WITH ADDITIVE MANUFACTURING.

James Pierce*, Christopher Copeland, and Jorge Zuniga, Department of Biomechanics, Will Picken, Department of Electrical Engineering, University of Nebraska at Omaha, Omaha NE 68182, Jean Peck, CHI Health, Omaha.

Despite the frequency of musculoskeletal injuries such as sprains, broken bones and torn ligaments [1], treatment options are often costly, time-consuming and ill-fitted.[2,3] Additive manufacturing (“3D-printing) allows for the production of highly-customized and inexpensive assistive devices [4], which suggests potential efficacy in the prescription of splints and casts for musculoskeletal injury.[3] In the present study, a parametric, customizable splint/cast was created using a computer-aided design (CAD) package (Fusion 360, Autodesk, San Rafael, CA, USA) and produced with low-cost, desktop 3D printing (Ultimaker 2+ Extended, Ultimaker, Geldermalsen, Netherlands). Fitting of the devices was performed on five healthy subjects (mean age 23.6 +/- 1.51 years, n = 4 male), and function was assessed by a certified clinician in comparison to commonly prescribed devices. The function of the custom, 3D-printed assistive devices was found to be similar to that of standard wrist splints and short arm casts, with the added benefits of reduced weight, enhanced water resistance and better ventilation. These results suggest that additive manufacturing may be promising in the treatment of common musculoskeletal injuries. 1. Holder NL, Clark HA, DiBlasio JM, Hughes CL, Scherpf JW, Harding L & Shepard KF, Physical therapy, 79(7), 642-652, 1999. 2. Dombroski CE, Balsdon ME, & Froats A, BMC research notes, 7(1), 443, 2014. 3. Kim H & Jeong S, Journal of mechanical science and technology, 29(12), 5151-5156, 2015 4. Zuniga JM, Peck JL, Srivastava R, Pierce JE, Dudley DR, Than NA & Stergiou N, Disability and Rehabilitation: Assistive Technology, 1-7, 2017.

IMPLEMENTATION OF A 3D SCANNER ARM.

Walker Arce*, James Pierce III, and Jorge Zuniga, Department of Biomechanics, University of Nebraska at Omaha.

Three-dimensional scanning technology has reduced dramatically in price and ease of implementation. Unfortunately, these low-cost, three-dimensional scanning systems lack intuitive tracking during the scanning of a part. This leads to issues with mesh alignment during scanning, inaccuracies in the completed mesh and additional time to scan completion. This is problematic, especially when dealing with human subjects, where fatigue and impatience become a problem for the completion of a stationary scan. To address this, we have developed a low-cost, simple to use, and repeatable apparatus which rotates any scanner or camera about the central axis of the part being scanned.

WALKING ON INCLINED SURFACE ENHANCES OBSTACLE NEGOTIATION CAPABILITY FOR ASTRONAUTS.

Devan Sedlacek, Weihua Li*, Jiani Lu, and Jung Hung Chien, Department of Physical Therapy Education, University of Nebraska Medical Center, Omaha.

After astronauts return to Earth from space, their standing and walking balance has already been severely affected by the alteration of gravity. Specifically, negotiating obstacles without tripping becomes a challenging task. This problem highly relates to inaccurately calibrating the body-centered coordinate system in adapting environments due to the malfunction of sensory systems. Therefore, to train walking on the inclined surface might one of potential solution to train astronauts to adapt different challenged environment rapidly because both motions require special control mechanism to raise the leading leg up. Therefore, this study attempted to compare the similarity between walking on inclined surface and stepping over the obstacle. Eight healthy young subjects attended this study. Ten retro-reflective markers were placed on greater trochanter of femur, lateral epicondyle of the femur, lateral malleolus, second metatarsophalangeal joint and heel of both legs and one was on the sacrum. All subjects were asked to perform two tasks: 1) walking on an inclined treadmill with different grades (0%, 5%, 10%, 15%) at their preferred walking speed for 2 minutes; 2) stepping over a single obstacle with different height (the vertical distance from ground to the slope of 0%, 5%, 10%, and 15% with respect to grades of inclined treadmill). A Pearson correction was used to investigate the relationship of toe clearance between motions. The correction of toe clearance was a significant, positive, and moderate. This finding was convincing because it inferred that to train walking on the inclined surface will be the benefit of enhancing the capability for obstacle negotiation due to the transfer leading effect. Therefore, it is feasible to train astronauts on the treadmill then transfer the learning effect to real-life obstacle negotiation.

IMPACT OF GENDER CHARACTERISTICS, EMPATHY, AND STRESS ON TASK PERFORMANCE RELEVANT TO NASA MISSIONS.

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The ability to understand the perspectives of others is an important component of teamwork and communication, especially in stressful work environments, such as NASA space missions. Certain aspects of personality may play a key role in mediating stressful social situations and facilitating optimal outcomes during task performance. We aim to assess the degree to which performance on a cooperation task is affected by empathy, stress, and perceptions about gender characteristics. The sample included 50 healthy adults aged 19-89 years (M = 66.07). Well-validated self-report measures were used to assess stress, empathy, and the degree to which individuals perceive themselves to have specific gender-

associated personality traits (e.g., femininity and masculinity). Participants also completed a cooperation task in which they made decisions about monetary resource allocation after undergoing an empathy induction and again in a neutral context. Subjects with greater levels of momentary empathy during the task reported personality characteristics associated with greater femininity [$r(50) = 0.42$, $p = 0.003$]. Furthermore, higher levels of femininity were also associated with greater resource allocation on the cooperation task [$r(50) = 0.34$, $p = .02$], and higher levels of trait cognitive empathy [$r(50) = 0.43$, $p = 0.003$]. In comparison, individuals who reported higher levels of masculinity, had lower trait levels of stress [$r(50) = -0.33$, $p = 0.02$], and lower personal distress (e.g., upset) in response to the empathy induction [$r(50) = -0.33$, $p = 0.03$]. Our results suggest that individuals who perceive themselves to have greater femininity are more likely to experience empathy and show cooperation, whereas those with higher levels of masculine traits may experience reduced stress. Understanding the contribution of a wide range of personality traits to task performance in the general population will provide a basis for applying this knowledge to specialized populations, such as astronauts and ground crew.

HD-TDCS DIFFERENTIATES FRONTO-VISUAL THETA LATERALIZATION DURING VISUAL SELECTIVE ATTENTION.

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The ability to allocate attention to pertinent information within a larger visual field, while simultaneously inhibiting distracting or irrelevant information is essential to carrying out goal-directed behaviors. Studies of visual attention have implicated oscillatory activity in the temporal recognition, protection, and organization of attended representations in visual cortices. In addition, studies have shown that higher-order regions such as the prefrontal cortex are critical to attentional processing, but far less is understood regarding laterality differences serving attention in the prefrontal cortices. To this end, we examined the impact of applying high-definition transcranial direct-current stimulation (HD-tDCS) to the left or right dorsolateral prefrontal cortex (DLPFC) on subsequent attentional processing. We predicted that HD-tDCS of the left versus right prefrontal cortex would differentially modulate performance on a visual selective attention task, and alter the oscillatory activity serving such cognitive processes. Our crossover study design included 25 healthy adults that underwent three separate sessions of HD-tDCS (sham, active left-, and active right-DLPFC) for 20 minutes. Following stimulation, participants completed an attention paradigm during magnetoencephalography (MEG). The resulting oscillatory responses were imaged in the time-frequency domain using beamforming, and peak task-related neural activity was subjected to dynamic functional connectivity analyses to evaluate the impact of stimulation site (i.e., left and right DLPFC) on neural interactions. Our results indicated that HD-tDCS over the right DLPFC differentially modulated a right-lateralized network of fronto-visual functional connectivity within the theta band compared to HD-tDCS of the left DLPFC. Further, these tDCS-induced alterations uniquely explained behavioral performance on the Flanker task. Importantly, these findings provide a unique network-specific insight into the complex oscillatory mechanisms serving visual selective attention. These data have a clear impact on the aerospace field, as efficient attentional processing is of paramount importance for the safety and success of all missions and personnel involved in space flight.

ANTHROPOLOGY

VERBAL AND NONVERBAL CHANNELS OF COMMUNICATION AFTER COMPLETING TASKS VARYING ON TASK DIFFICULTY.

Philip Lai*, Rachel Southard, Breana Johnson, and Elaina Eddy, University of Nebraska-Kearney

A successful conversation requires the coordination of many abilities, for example, one must, plan, organized, integrate, and execute the message, all online and in real-time. As this process occurs, verbal and nonverbal channels (i.e., eye contact, gestures, facial expression) can convey crucial information such as one's current affective state and current attentional focus. In this study, verbal and multiple channels of nonverbal behaviors were examined after participants completed tasks differing on complexity level. Difficulty varied by mental and physical exertion needed to complete the task. There were three different levels of physical activity, the first being the most physical where individuals are completing a task on their feet, the second level being a physical activity only requiring their hands as the individual would be sitting down and finally the third level where the individual would be sitting down and reading a manual. Using the software platform Eudico Linguistic Annotator (ELAN), multi-tier annotations were created based on behaviors observed from video data. Comparing pre-interview with post-interview, a trend was observed where individuals completing more difficult tasks not only decrease their verbal language output but also produced fewer expressive social behaviors, suggesting the importance of context. Taken together, the context of the interview and task exertion seems to have an effect on an individual's eye gaze behavior, gesture rate, and facial expressivity when conversing in an interview. Perhaps the performance on the task (i.e. having difficulty completing the task) may influence how individuals would express themselves after the task has completed.

USING VIRTUAL REALITY AND DIGITAL ARTIFACTS TO ENHANCE DATABASE STRUCTURES AND FACILITATE DATA REUSE.

Cole Juckette, Department of Anthropology, University of Nebraska-Lincoln

Using database programs to store, archive, and organize data has been an established method of digital archaeology and the humanities for decades now. Only relatively recently has the ability for researchers and analysts to create reliable digital surrogates taken center stage in archaeological publications. Along with these digital assets came a myriad of single object viewers based both on the web and in sophisticated software. The focus of these programs was narrow and only drew into view the object in question in great detail. The MayaCityBuilder program uses GIS and LIDAR data to recreate the landscape and features of the Copan river valley including the ancient Mayan city of Copan in a virtual space that can be explored immersively. Using this as a kind of virtual lattice we embed object data into the actual landscape of Copan, which can be explored by end users through the use of a virtual reality headset. Using the virtual landscape as the database structure allows us to explore "object identity", object relation to space, and a new paradigm of database management and exploration. By using the landscape as the primary medium through which the user both accesses and uses the data, we create an experiential platform that serves many of the same functions of the traditional database while allowing users to gain a more interpretive relationship with the data. In turn this structure provides for massive data reuse by creating a platform designed to draw the focus much wider than what single object viewers allow for and sustainability that encourages public use and exposure.

SYNCRETIC ARTWORK OF THE CHILAM BALAM.

Amy Sue Peterson, Department of Anthropology, University of Nebraska-Lincoln

The Maya of the Yucatan Peninsula were not without beliefs, language, arts and a mode of living before the arrival of the Spaniards in the early 1500s. In fact, they had their own language, both written and spoken, as well as their own calendric system, and other markers of a civilized culture. Once the Spaniards arrived, they forced the Maya to renounce their beliefs, and their way of life in order to take on Christianity. But did they completely convert the Maya? Were they able to rid these "pagans" of their false beliefs? They believed they had and were keen to impress their king. Yet, the Maya did not forget everything, neither did they completely surrender to their new leaders and their rules. What occurred was a blending of the two societies, known as "syncretism" – where objects, beliefs, activities, and other facets of life are blended into something new. In this presentation, I look at two of the Chilam Balam books for the Yucatan region, with respect to the information provided, including day names, and the Zodiac, from a Post-Conquest Mayan view. These books were written by Mayans under the direction of their Spanish lords, who used the books to inform the Spanish king of "how things were going" in the new lands. The results – the syncretic works – are interesting in what they portray, telling the histories of the Maya in a medium that is neither completely Mayan nor Christian.

LOW-POWER USE-WEAR ANALYSIS OF OBSIDIAN ARTIFACTS FROM THE EL INGA/SAN JOSE SITES, ECUADOR.

Paige Herrera, Department of Anthropology, University of Nebraska-Lincoln

The assemblage that I am currently working with is from the Ilaló region of Ecuador. This specific assemblage is a collection that is comprised of 82 artifacts made from obsidian and 2 of basalt. The Cameron Collection is from San Jose, Ecuador, near the oldest archaeological site in Ecuador, El Inga. El Inga and the related San Jose site are some of the earliest pre-columbian hunter-gatherer sites in Ecuador. During the paleo indian period the area was both a campground and a workplace. Around 80,000 lithic artifacts were excavated during the 1960s. The site was continuously inhabited for about 5,000 years beginning in 7080 and ended in about 1969 B.C.(El Inga website)

When reading other articles I realized that they talked about the typologies that were used to identify the artifacts. At first that was the way that I looked at the part of the collection that I have available to me, with the typological outlook, but then after looking closer, it was obvious that several of the artifacts have patterned linear striations. The striations run perpendicular to the edge. I have yet to come across an article that has anything about use wear on the obsidian artifacts coming out of Ecuador. These use wear lines have now become the focus of my research. The striations seem to be from planning. One idea is that the obsidian lithic artifacts could have been used in the creation of wooden tools that did not survive to be added into the archaeological record.

CERAMIC AND OSL ANALYSIS AT 25HO21.

Ryan Mathison, Department of Anthropology, University of Nebraska-Lincoln.

The Humphrey Site is an archaeological site located on private land in west-central Nebraska in the Sand Hills. The site, 25HO21, was first located and excavated as part of the Missouri River Basin Survey. It was put on the National Register of Historic Places, but that nomination included some information that was slightly incorrect in regards to location. With this in mind, and with a desire to conduct an excavation utilizing newer detailed recovery methods, History Nebraska reinitiated work at the site in collaboration with the University of Nebraska-Lincoln, University of Iowa, and University of Oklahoma. Two field seasons were spent at Humphrey, first in 2017 and then, with a larger

contingent, mainly from a UNL field school, again in 2018.

This paper, presenting my own thesis work, will be conducted within the scope of this larger project, with the goal of helping to finish the process by thoroughly analyzing the ceramics from the site, while also aiding in properly dating the site through the use of Optically Stimulated Luminescence (OSL) on ceramic sherds from the three houses located at the site. This work is being conducted in large part due to the success that Nora Greiman and Dr. LuAnn Wandsnider have had in using OSL in the Sand Hills. This analysis is in collaboration with Dr. Paul Hanson from the School of Natural Resources. The goal is to understand the relative dating of the houses at the site while also verifying, or disproving, the dates currently provided through radiocarbon dating. This data, along with that from the ceramic analysis, including analysis of characteristics including weight, size, form, paste, temper, decoration and so on will be presented together.

COMPARING PRIMATE DENTAL DEVELOPMENT AMONG *GORILLA GORILLA* AND *GORILLA BERINGEI* SPECIES.

Rachel Dickerson and Emily Hammerl, Department of Anthropology, University of Nebraska-Lincoln

Primate dental development is an instrumental tool both in the determination of age in individuals and in the estimation of life history patterns in past species. The aims of this study are to summarize relevant previous research on the subject and to document the development of the deciduous teeth in the species *Gorilla*. While the majority of primate dental ontogeny research has been conducted on chimpanzees, few studies have focused on gorillas, and studies on gorillas largely focus either on *Gorilla gorilla* or *Gorilla beringei*. Moreover, previous research into dental development largely focuses on development of permanent teeth; however, deciduous teeth are less affected by environmental influences due to genetic constraints in earlier development, and thus are more indicative of heritability of developmental patterns than permanent teeth. Accordingly, they are more likely to reflect species-specific developmental patterns. In order to address these gaps in the current research on deciduous dental development in apes, this study focuses on the development of deciduous teeth and permanent teeth, drawing comparisons between *G. gorilla* and *G. beringei*. Here, radiographic images from the mandibles of 44 nonadult individuals from museum collections were scored using a dental age method. Both age for stage, including midpoint age at attainment values, and stage for age statistics, which describe the average age at a given stage and average stage for a given age, are provided. This talk will discuss the results of the study, as well as implications for the larger conversation of primate and hominid ontogeny and life history.

OSTEOLOGICAL PATHOLOGY IN HUNTER-GATHERER POPULATIONS.

Bailey Ottel, Department of Anthropology, University of Nebraska-Lincoln

The topic of discussion in this paper is on human diseases and their impact on different populations. Specifically, an emphasis is placed on not only how disease affects the body, but specifically how different pathologies present on the skeleton. The prevalence of specific diseases across geographic space will also be analyzed and explained within the framework of clinal variation. The specific skeletal pathologies that will be analyzed within different populations of people include cribra orbitalia, porotic hyperostosis, harris lines, linear enamel hypoplasias, and caries. The differences between hunter-gatherer populations and more complex, agricultural ones will be analyzed to show how different lifestyles that exist within these populations can affect the types of diseases that are prevalent. Through the analysis of pathology, as presented on the skeleton, the differences between geographic regions and lifestyle patterns will show that hunter gatherers typically have less of these diseases.

"VISCERAL CARTOGRAPHIES" OF AZERBAIJAN AS STANDARD STORIES OF VICTIMHOOD: USING SITUATIONAL ANALYSIS IN GEOPOLITICAL RESEARCH.

James Baker, Department of Geography, University of Nebraska-Lincoln

Since independence from the USSR in 1991, scientistic maps produced in Azerbaijan export a legally normative cartographic image of prior Soviet borders recognized by the international community. When 'logoized' and reproduced in the service of both popular and state-guided commemorative practices, these maps often take on animal or body-like qualities, informing a geopolitical culture which enacts claims to national identity through somaticized landscapes and territoriality. I use Situational Analysis to map and memo visual data of ~320 images documenting two defining moments in Azerbaijani nationhood – 1990's 'Black January' massacre and the 1992 Khojaly massacre – sampled across ~200 public and government websites hosted in Azerbaijan between 2016-2019, in addition to photographs collected in situ in 2013. Preliminary findings suggest a theory of 'visceral cartography' which constitutes embodied affective-discursive practices characterizing discourses of life (including children, families, flora, fauna, and survivances of national traumas), death (such as ecocides, ethnocides, and Şəhidlər - 'martyrs'), and the inanimate (war materiel, memorials, museums, knowledges, and public space) present within visualizations of national space. I contend that visceral cartographies are mobilized on a transnational scale to perform 'standard stories' of victimhood in a way that scientistic maps cannot, centered on two major historical factors: international indifference over Soviet use of military force against Azerbaijani civilians during the 1990 'Black January' emergencies, and tensions arising from de facto Armenian governance of and de jure international recognition of Azerbaijani rights to the territory of Nagorno-Karabakh. Geopolitically, these visceral cartographies are used to raise awareness of Azerbaijan's sorrows through public diplomacy, with the goal of legitimating Karabakh's return to Azerbaijani rule. Critically, these processes imply the adaptation of a social and spatial pedagogy which trains a 'gaze of the citizen' on national-cultural values ascribed by the state, bearing significant implications for civil society after a century of autocratic rule.

THE ARABIAN BEDOUIN: AN IMPOVERISHED NOBILITY.

Sarah Ghannam, Department of Anthropology, University of Nebraska-Lincoln

This paper focuses on the shift from a nomadic Bedouin society to a modernized and sedentary Bedouin society by providing information regarding the formation of the Kingdom of Saudi Arabia, the government pressures on the Bedouins, and the Bedouin embracement of new technologies. Through research taken from both new and old history books, personal accounts of interactions with Bedouin tribes, and an interview with His Royal Highness Prince Sultan bin Salman bin Abdulaziz conducted via voice-text messaging, information regarding these topics has been synthesized in order to demonstrate the changes observed from traditional Bedouin culture to that of the modern Bedouin. This paper includes a brief summary of the land comprising Saudi Arabia in order to depict the habitats of the Bedouin. It also includes information regarding the modern culture of Saudi Arabia to illustrate the vast influence that the Bedouin people had on the kingdom. Finally a brief discussion of the formation of the Kingdom of Saudi Arabia is included, though it should be noted that this piece of history is told different by different parties, views of whom are not fully represented here but have been documented in depth elsewhere. It was found that many factors played a role in the changing Bedouin culture, but that traditions live on in the few communities that choose to remain in the desert and in the kingdom as a whole.

EXPLORING ETHNOGRAPHIC METHODS IN NONTRADITIONAL CONTEXTS: A STUDY OF PUBLIC LIBRARIES AND LITERACY ACHIEVEMENT.

Tiffany Young, Department of Teaching, Learning, and Teacher Education, University of Nebraska-Lincoln

While early literacy achievement continues to be stratified by social class in America, public libraries in low-income neighborhoods often offer space and programs to bolster the early literacy development and achievement of youth in their surrounding community. *Storytime* is one such program that can contribute to this goal though there is a paucity of research exploring how this community support can expand its constituency. This study uses ethnographic methods to richly describe and analyze the cultural context of the public library and seeks to provide the participants' perspectives of how storytellers act in ways to attract and maintain family participation in this free, voluntary literacy event at the public library in a lower-income neighborhood in the Midwestern United States. Data collection included participant observation, semi-structured interviews with storytellers, and artifact collection. The following themes emerged: *getting them in the door, appealing to patrons, fostering enjoyment, nurturing relationships, facilitating learning,* and *offering flexibility.* By offering a contextualized account of the work of storytellers, the findings of this study suggest that strengthened partnerships with both neighborhood schools and families may increase the attendance of children in storytime programming. Increased attendance at storytime programs in low-income neighborhoods may serve to decrease the early literacy achievement gap. This session will explore this study via a methodological lens with a specific focus on how ethnographic methods were employed within this nontraditional setting. Participants will be invited to discuss other potential applications of ethnographic data collection and analysis.

THEY WALKED WITH THE BUFFALO: A RESPONSE TO ANGLO-AMERICAN PERCEPTIONS OF MANDAN WOMEN.

Jayne Kinney, Department of History, University of Nebraska-Lincoln

Slaves, debauchery, and prostitutes: Anglo-American explorers and fur traders used these terms to describe Mandan women. These observers saw the Mandan's action as prostitution or as affirmations of the Anglo-American's irresistible masculinity; however, these perceptions stem from a fundamental misunderstanding of the role of women in Mandan society and the spiritual and ceremonial practice of "walking the buffalo." This research decenters the historical narrative placing Mandan women at the heart of their experiences instead of masculine Anglo observers and emphasized the role and agency of women in their intimate and ceremonial lives. Through the examination of indigenous narratives recorded in published anthropologies as well as archival sources at the North Dakota Historical Society feminine agency, sexuality, and relational autonomy emerge. First, the narrative critiques the existing historiography surrounding "walking the buffalo." Next, indigenous accounts of "walking the buffalo" are put in context with other examples of sexual and relational agency including courting, marriage, and divorce practices. Finally, "walking the buffalo" is examined as part of larger Mandan feminine ceremonial and spiritual culture. Mandan women occupied places of reverence and power within their national structures and became conduits for spiritual and economic power through "walking the buffalo," the religious practices of transfer spiritual power from elders and individuals with spiritual power through sexual intercourse or prayer and controlled the dispensation of this power to next generation of social and spiritual leaders.

DEVELOPING AN AUGMENTED REALITY TOUR OF CAMPUS HISTORY USING GEOGRAPHIC INFORMATION SYSTEMS AND 3D MODELING.

Jancy Nielson, Heather Richards-Rissetto, and Effie Athanassopoulos, Departments of Anthropology and Classics, University of Nebraska-Lincoln

Augmented reality has been a growing fascination in preserving history. This project includes 3D models and photos of historical artifacts and maps, but it also generates new 3D and GIS data to create an augmented reality (AR) tour highlighting key aspects of UNL's history. Data was comprised from floor plans to compose 3D renderings of UNL's original Chemistry building, which was then transposed into AR. The AR tour dives into an interactive map with POIs (points of interest) where people use their mobile phones or tablets to retrace UNL's history. Specific POIs for this project include a history of the building ranging from the first female Chemistry teacher, her workspace, instruments used, and contents within a time capsule recovered in 2014. Generally speaking, the "AR Campus Tour" project serves as an online portal for public outreach and education, making UNL an integral part of Lincoln's early history and the broader Great Plains region. Additionally, the data generated in the project will be added to the "UNL Campus Archaeology" Project allowing students address specific research on various aspects of the history of UNL, Lincoln, and Nebraska.

APPLIED SCIENCE AND TECHNOLOGY

DETECTION OF CANNABINOIDS FROM MARIJAUNA FLOWER, CONCENTRATE AND TOPICAL USING COLORIMETRIC SENSOR ARRAYS.

Andres V. Mora*, Michael Kangas and Andrea E. Holmes, Department of Chemistry, Doane University, Crete, NE; and Amanda DeBono, AgriScience Labs, Denver, CO

Current methods for the detection of marijuana, specifically for the THC compound, by law enforcement include colorimetric methods such as the Duquenois-Levine test. This test requires the use small quantities of hazardous components, such as hydrochloric acid and chloroform. Furthermore, there have been arrests due to false positive given by this field testing method. Colorimetric sensor arrays present another method for field testing these substances and many other analytes; including, but not limited to, acids and bases, pesticides and warfare agents (explosives and nerve agents). The ability to have multiples sensors arranged on the array allows for an accurate, fast, easy to use, and low-cost method of detection of analytes. In this study, we analyzed over 800 samples of marijuana flower, concentrate and topicals in which the RGB (Red, Green, and Blue) values of 44 sensors were recovered using an ImageJ macro methodology after the colorimetric arrays were exposed to the analytes. The values were analyzed using Principal Component Analysis (PCA), gathering loading and PC biplots to test the detection ability of the sensors. As a product, seven sensors were identified as the best detecting marijuana flower, concentrate, and topical at concentrations ranging from 0.15mM to 3.4mM; confirmed by HPLC. The result of this study is a new colorimetric sensor array specific for the detection of cannabinoids. Based on the 7 sensors selected, colorimetric changes can be analyzed using digital methods, leading to the development of smartphone apps able to perform this analysis.

IMPROVING ASSESSMENT METHODS OF TARTARIC ACID IN WINE.

Jasmine DeMonte* and Darius Agoumba, Department of Physical Sciences and Mathematics, Wayne State College, Wayne, NE

Tartaric acid is an organic acid present in wines. It defines the quality of wines as it affects their taste, color, and microbial stability. Recently, an analytical method was developed to assess red wine quality by monitoring the amount of tartaric acid using simple camera phones and scanners. The

method allows the user to take pictures of the changes in colors in red wine during its titration with sodium hydroxide. It is our belief that the latter technique was not reliable and needs improvement. We found that the use of spectrophotometer during the titration of red wines gave a better estimation of tartaric acid in the wine samples. In the present study, the instrument was used to collect absorbance spectra of red wine samples titrated with sodium hydroxide. Changes in the spectra intensities during the titration process were used to build titration curves. Endpoints from the spectrophotometric titration technique were compared to the observed endpoints obtained previously using potentiometric and conductimetric titration techniques.

DEVELOPMENT OF A MANUFACTURING METHOD FOR SUPER COILED POLYMER ACTUATORS.

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Actuators are a commonly used tool, however, they are often mechanically complex and require many small parts. A new approach is to use solid state actuators (SSA), which rely on induced strain in bulk material to create a displacement. One kind of SSA that has been developed is known as a super coiled polymer actuator. A super coiled polymer actuator is created with a single string of a conductive thread that is continually twisted around itself until coils are formed. Applying a current to this super coiled thread will cause it to heat up and contract, resulting in a method of actuation. This system has been shown to rival the performance of biological muscles, and can be manufactured with cheap, off the shelf components. This group has developed a manufacturing method for producing super coiled polymer actuators that will reliably and quickly create accurate actuators.

MARS 2020 HELICOPTER: ENHANCING MISSION AND TECHNOLOGY OBJECTIVES THROUGH SIMULATION.

Chance Adolf, Department of Physical and Life Sciences, Chadron State University, Chadron, NE

Engineers at NASA/JPL have designed an autonomous helicopter UAV for the Mars 2020 payload intended to enhance data collection capabilities of the rover. Mars 2020 objectives include: 1) conduct an integrated set of context, contact, and spatially-coordinated measurements to portray the geology of the Jezero Crater, 2) characterize paleo-environments with a focus on identifying rocks capable of preserving signs of astro-biological potential, and 3) prepare and cache compelling samples for future return to Earth. Additional mission objectives of Mars 2020 are to facilitate human exploration by making substantial advances toward filling strategic knowledge gaps, as well as demonstrating additional technologies crucial for future Mars exploration. UAV technology has been used in the geosciences to capture high resolution imagery providing the ability to fill the gap between high areal coverage of orbital imagery and the outcrop (rover) scale. UAVs equipped with advanced image processing software, such as structure from motion (SFM), have the ability to generate 3-dimensional models from high resolution 2-dimensional aerial images at low elevations. UAV technology equipped with SFM software could greatly advance Mars intuition by delivering models that accurately depict the geology and terrain. These models can be used for risk assessment, to locate areas of geologic significance, and to reduce the expense of navigation. The goal of this study is to assess the value of the Mars 2020 Helicopter and demonstrate its capabilities in tests at a terrestrial analog site with conditions similar to those expected during the Mars 2020 Mission. The test, conducted in the Mojave Desert, California, USA, will assess an area that is comparable to the Jezero Crater. A tentative navigation route will be determined using features on satellite and aerial imagery. Once the route is chosen, a camera equipped UAV will be flown to obtain high resolution imagery at low altitudes. SFM

software will then be utilized to develop 3-dimensional models to interpret features and assess the potential rewards of prospective rover exploration sites. Collected information will be analyzed by a root-mean-square error (RMSE) data assessment to determine the accuracy of the spatially-oriented measurements.

"SMART" NEST BOX TECHNOLOGY: UTILIZING UNIQUE ADVANTAGES WITHIN COMMUNITY COLLEGES TO EXPEDIENTLY AND REMOTELY COLLECT AVIAN DATA.

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Community colleges systems significantly contribute to STEM major areas at baccalaureate institutions. Students planning to forge academic paths to obtain advanced degrees in life or engineering sciences can benefit from program areas in mechatronics and computer science as coding functionality becomes an essential skill across disciplines. We are a community college student-cohort funded by a National Science Foundation S-STEM scholarship program; we proposed a project bridging gaps across disciplines while providing accessible technology to avian (or mammalian) cavity-nesting researchers or enthusiasts.

We propose an evolving "smart" nest box iteration intended: 1) to obtain data (e.g. plumage reflectance or specific song-recordings) requiring costly equipment, 2) to reduce nest disturbance while monitoring breeding, more efficiently collecting data, and, 3) to create a cost-efficient, accessible model. We will utilize 3-D printing and design technology to assist housing and powering box technology. We will integrate sensing technologies utilized in quality assurance industrial manufacturing. We plan to apply either a design of systems used in industry or integrate systems utilizing a Raspberry Pi and python, and industry guidance. We look to build on troubleshooting suggestions of other smart boxes models, such as creating algorithms to vary minimum frame rates of cameras during set time periods, and, increase them as necessary based on bird activity levels to reduce power consumption. We plan to build and test this system in the upcoming 2019 breeding season and report specific methods and results of data collected.

A FORMAL APPROACH TO CIRCLE FORMATION IN MULTI-AGENT SYSTEMS.

Rui Yang*, Azad Azadmanesh and Hassan Farhat, Department of Computer Science, University of Nebraska-Omaha, Omaha, NE

A Muli-Agent System (MAS) is a distributed system where the agents have the ability of sharing and exchanging information to accomplish a common goal. An agent is a computing element that could be a software code residing on a computer, a processor, a node in a network, or a robot such as a drone. A fundamental problem in MASs is the cooperative control of the agents under the influence of localized information exchange. Distributed control will allow for higher performance and fault tolerance. Formation control is in reference to maintaining a pattern among the agents on a spatial scale. This study is focused on the circle formation among agents, which is the basis for transforming the formation into other symmetrical patterns.

A major shortcoming of a number of studies on circle formation is the fact that the approaches are ad hoc. Furthermore, many research efforts assume each agent has the global view of the field or the ability of communicating with all agents directly, and assume agents are transparent to avoid dealing

with the collision problem. Finally, hardly any study has focused on an approach that distributes the agents elegantly and evenly using localized communication. This study presents a formal approach to the circle formation of a large number of agents. The agents will cooperatively adjust their positions to evenly distribute themselves on the circle. The proposed approach will also depend on the assumptions that the observation and communication are limited to the neighbors, and the agents are mass agents. This in progress research will present the formal approach followed by some simulations.

PERFORMANCE COMPARISON OF SDN CONTROLLERS USING DIFFERENT NETWORK ENVIRONMENTS.

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Software-Defined Networking (SDN) is a dynamic, and manageable network architecture which is more cost-effective than existing network architectures. The idea behind this architecture is to centralize intelligence from the network hardware and funnel this intelligence to the management system (controller).

In the SDN architecture, a single centralized controller can control several network switches. It is important to find which controllers perform well over SDN, how many controllers are required and where they should be located in the network. There are different controllers (based on C, Python and Java programming languages) available for SDN. This project implements Floodlight (Java based), POX and RYU (Python based) OpenFlow controllers in a tree networking topology using SDN. The POX and Floodlight controllers have been implemented under Mininet and Ryu has been implemented under GENI. The controllers are evaluated with respect to their network parameters such as Round Trip time, Bandwidth, throughput and their loss. To assess the performance of three controllers, different tools like Iperf and Wireshark for Transmission Control Protocol have been used. For testing purposes we used GENI test bed and Mininet emulator.

The result of the evaluation shows that all three controllers (Floodlight, POX and Ryu) allow us to install appropriate rules in the switches using the OpenFlow API. We found that all three controllers have a low average response time but Floodlight SDN controller has a lowest average response time as compared to Python based controllers. In particular, our findings reveal that Floodlight controller has excellent network performance in terms of throughput and round-trip time rather than Ryu and POX over SDN. Also, the Floodlight controller has an excellent tool for deploying and testing SDN applications in Mininet. Finally, we concluded that we can improve throughput by increasing TCP window size for TCP connections.

BIOLOGICAL AND MEDICAL SCIENCES

SESSION A

USING WEARABLE ROBOTICS TO REVEAL THE TIME PROFILE OF METABOLIC COST

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In modern biomechanics labs, we can measure kinematics, kinetics, and electromyography (EMG) at hundreds of frames per second; however, we cannot measure the time profile of metabolic cost within the stride cycle. The inability to pinpoint which part of the walking cycle causes an increase in metabolic cost in populations with gait disabilities (e.g., stroke patients or amputees)

complicates our understanding of these disabilities. Our aim is to develop methods to experimentally derive the time profiles of metabolic cost within the stride cycle of walking using robotic perturbations. We developed an attachment structure that allows applying forward force profiles from a cable-pulling robot (HuMoTech) tied to a waist belt with a load cell. We conducted metabolic cost measurements in three healthy participants during walking with 33 different force profiles as a function of step time. Preliminary results show the highest reductions in metabolic cost (avg. -32%) in conditions with an average peak force magnitude around 13% of body weight (BW) where the timing of the peak force roughly coincides with the timing of horizontal center-of-mass acceleration. A next step will be to use this data to characterize the statistical relationship between the average metabolic cost and biomechanical time series under different perturbations and use this relationship to estimate the time profile of the metabolic cost of the unperturbed stride cycle. The ability to measure the time profile of metabolic cost could be useful for detecting the least metabolically economic phase in individuals with gait disabilities, developing targeted rehabilitation therapy (e.g., robotic resistance during least economic phase) and optimizing assistive devices (e.g., exoskeletons that assist during the least economic phase).

ANTIMICROBIAL PROPERTIES OF ETHER-CONTAINING 1,3,4-TRISUBSTITUTED-1,2,3-TRIAZOLIUM SALTS.

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1,3,4-Trisubstituted-1,2,3-triazolium salts are quaternary ammonium compounds (QACs) that have been observed to act as antibacterial and antifungal agents. The antimicrobial properties of these compounds vary with substituent identity. The goal of this study was to analyze the difference in antimicrobial properties of various quaternary compounds that were substituted at the 1,3, and 4-triazolyl positions with assorted hydrophobic phenyl substituents. A library of salts was prepared with 2-phenylethyl, 3-phenylphenoxymethyl and 2,6-dimethylphenoxymethyl groups at the C4 position. Each compound was produced using a sequence of azide-alkyne cycloaddition and benzylation steps. The formation of rearranged side products at the N1 and N3 positions was observed when the C4 position was substituted with an ether analog and the N1 and N3 positions had different substituents. The antimicrobial properties of the triazole compounds and triazolium salts were evaluated using microdilution minimum inhibitory concentration (MIC) assays. MIC activities as low as 2 micromolar against gram-positive bacteria, 16 micromolar against gram-negative bacteria, and 2 micromolar against fungi were observed. MIC potency was affected by the relative hydrophobicity of the substituents at the N1, N3, and C4 positions. Tolerance of the ether functional group at C4 supports the potential to incorporate fluorophore units at this location, allowing for future fluorescence microscopy imaging studies to be undertaken. Details regarding the synthesis, characterization, and antimicrobial assays of these compounds 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.

FLEXIBLY SWITCHING POSTURAL RESPONSES BETWEEN STRUCTURED VISUAL STIMULI DEPENDS ON THE TEMPORAL DETERMINISM OF THE STIMULI.

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Healthy postural sway is characterized by the ability to respond and adapt to changes in the environment. These adaptations allow us to maintain balance while performing different tasks (e.g.

on a ship at sea or in space). However, when such environmental conditions quickly change among several different conditions, whether we can flexibly adjust our postural responses, is not clear. Studying such flexibility patterns could provide insight into alleviating abnormal sensorimotor recalibrations and enhancing adaptation to ever-changing stimuli in dynamic environments. The purpose of this study was to test the ability of flexibly switching postural entrainment from one stimulus structure to another. Fourteen healthy participants were recruited to voluntarily shift medial-laterally and attempt to match their sway to a moving visual stimulus. Both deterministic (periodic and chaotic) and non-deterministic (random) stimuli were tested individually (baseline) and in combination. The combination trials comprised of either 20 second sections of the random stimulus followed by 20 seconds of the periodic stimulus, repeating for three minutes or the same structure with the chaotic stimulus instead of the periodic. The degree of center-of-mass (COM) – target stimulus coupling was quantified using cross-recurrence quantification analysis (cRQA) which represents duration of coordination and cross-sample entropy (cSE) which represents the repeatability between the two signals. Results show significant section, condition and interaction effects ($p<0.001$) for both baseline and combination trials. Postural entrainment to the random stimulus was significantly different from periodic and chaotic stimulus across early to late trials. Across baseline and combined signals, the unpredictable stimulus showed an increase in repeatability and coupling duration across trials; and as a group had lower repeatability and coupling duration than the deterministic stimuli. The study showed the ability to flexibly switch between characteristically different patterns of visual stimuli depends on their temporal determinism.

INSECT VISITORS TO PRAIRIE FLOWERS: PROPORTIONS OF DIFFERENT GROUPS.

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Much discussion has recently occurred about the significance of butterflies as pollinators, especially for species of conservation concern such as the Monarch (*Danaus plexippus*) and the Regal Fritillary (*Speyeria idalia*). For butterflies to be important pollinators, they must not only be able to pick up pollen from flower anthers, faithfully visit individuals of the same flower species in succession, and deposit pollen on flower stigmas, but must also constitute a significant proportion of flower visitors. We recorded 3458 insect flower visits by 93 species to 33 flower species, during 18 observation sessions (totaling 19.5 hours) from June to September 2018, at Glacier Creek Preserve, Bennington, Nebraska. Beetles comprised the greatest proportion of flower visitors (1695 visits from 14 species, 49% of all visits). Butterflies comprised the second greatest proportion of flower visitors (744 visits from 27 species, 21.5%); Native bees comprised the third greatest proportion (506 visits from 10 species, 14.6%). No other insect group comprised more than 5% of visitors. Proportions of visits by different insect groups varied among flower species. For example, Tall Thistle (*Cirsium altissimum*) attracted more native bees (24.4% of visitors) and butterflies (14.2%) than did simultaneously flowering Rigid Goldenrod (*Solidago rigida*) (3.3% and 6.5%, respectively, while Rigid Goldenrod attracted many more wasps (11.1% vs. 0.2%). Our results suggest that, for prairie flower species, butterflies have the potential to be a significant pollinator group.

BIODIVERSITY OF VECTOR MOSQUITOES AT THE US MEAT ANIMAL RESEARCH CENTER.

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Landscape alterations and disease emergence are environmental concerns that intersect within aquatic habitats. Human disturbances, particularly those involving water management, can be either barriers or conduits that influence the propagation and persistence of vector-borne disease. The US

Meat Animal Research Center (MARC) contains farmland, water, and livestock. Here, a groundwater discharge channel from a water treatment plant transects the MARC for erosion, irrigation, and aquifer purposes. Additionally, the MARC is a flyaway for migratory waterfowl, including vectors of West Nile virus, and avian and mammalian species. In 2018, a surveillance of mosquito populations was conducted at the MARC. The diversity and abundance of mosquito species were calculated and the PCR amplification of West Nile virus. A total of 8,838 mosquitoes consisting of 9 species were collected at each site using CO2-baited CDC light traps. The most abundant mosquito species are Culex pipiens (86%), Culex tarsalis (9%), and Ochlerotatus trivittatus (3%). The data to be discussed for this study is part of an on-going, collaborative research program to provide a safe and reliable water management system, protect and manage an agricultural watershed from water-borne pathogens, and mitigate the propagation and presence of mosquito-borne disease at the MARC.

CONSISTENT SIMILARITY IN NEST DEFENSE BEHAVIOR BETWEEN EASTERN BLUEBIRD MATED PAIRS WITH BOTH UV AND MELANIN ORNAMENTS SIGNALING BEHAVIOR.

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Local environment may shape behavior, and regional variability in behavioral flexibility are crucial to anticipating how songbirds can survive and adapt to changing climates. Nest defense is adaptive as protecting reproductive investments are crucial to offspring survival and larger scale population growth, and territorial, ornamented songbirds allow examination of phenotype flexibility on multiple levels. Eastern bluebird-mated pairs in Oklahoma correlate interspecific nest defense increasing reproductive success, and responses are repeatable. In Alabama, males respond aggressively to conspecific, brighter, more chromatic, ultra-violet (UV) blue plumage of intruders. We present results of nest defense trials using a decoy predator and plumage reflectance data collected from Mississippi, and, propose replicating methods in bluebirds breeding along the Loup River in Columbus, NE.

Bluebirds inhabiting two sites were exposed to simulated predator intrusions during the nestling phase. Proximity to abiotic habitat features at one site positively correlates with female aggressive behavior and females nesting distal to abiotic structures at this same site are more vigilant. Mated pairs at both sites show similarity in defense. Less aggressive females at one site are more UV ornamented and less melanin pigmented, while more aggressive females at another site are more UV ornamented and more melanin pigmented. Darker melanic colored and more UV ornamented males are less aggressive at both sites, and relationships are stronger at one site. Results here prompt discussion of how differing environmental selection pressures may act more strongly on females and present unique reproductive issues regarding functional mechanisms in having or maintaining flexibility in such sexually selected traits.

THE USE OF BACTERIOPHAGE COCKTAILS TO DECONTAMINATE POLLUTED WATER, SURFACES, AND FOODSTUFFS.

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The decontamination of polluted water, surfaces and foodstuffs in developing countries has become a problem. In this study E. coli and two of its phages, T2 and T4 were used as a model for decontamination of water, fruits, vegetables, and surfaces. A cocktail of these phages were grown and titered. The phage cocktail was then applied to “dirty” water, fruits, vegetables, and solid surfaces.

Sampling the surfaces and water before and after applying the phage for comparison. Phage are an effective means for disinfecting water, solid surfaces, fruits, & vegetables. A cocktail of phage directed against the pathogens most likely to be found in a particular matrix will be effective for decontamination.

THE EFFECT OF NORA VIRUS INFECTION ON NATIVE GUT BACTERIAL COMMUNITIES AND LIFESPAN OF *DROSOPHILA MELANOGASTER.*

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Gastrointestinal microflora is a key component in the maintenance of health and longevity in both vertebrate and invertebrate species, such as Drosophila melanogaster. However, it is unclear whether non-pathogenic gastrointestinal viruses, such as Nora virus, play a role. To test this, we conducted a longevity study on Nora virus infected (NV+) and uninfected (NV-) D. melanogaster in relationship to presence (B+) or absence (B-) of the native gut bacteria. Four different treatment groups were generated, NV+/B+, NV+/B-, NV-/B+, and NV-/B-. Sixty virgin female flies were collected from each treatment group in triplicate and put into cages. Dead were collected every three days until the cages were empty. Kaplan-Meier survivorship analysis demonstrated that Nora virus may be detrimental to the longevity of the organism, whereas bacterial infection is beneficial and necessary. This data led us to hypothesize that there may be a difference in the types of bacteria species present in NV+ versus NV- D. melanogaster. Therefore, NV+ and NV- virgin female flies were collected every 6 hours and aged for 4 days. Surface sterilization followed by gut dissections were conducted, dividing the gastrointestinal tract into foregut, midgut, and hindgut, and the fat body was collected. DNA samples were sent to the UNMC Genomic Sequencing Core Facility for 16S Next Generation Sequencing to determine the bacterial communities that comprise the microflora of the gastrointestinal tract of NV+ and NV- D. melanogaster stocks. This data will help us to understand the unique and complex make-up of the gut microflora and how it affects the longevity and health of an organism when infected with a non-pathogenic virus, such as Nora virus. 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.

ASSESSING THE EFFECTIVENESS OF A NOVEL 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 to stimulate T cell- and antibody-mediated memory responses at mucosal pathogen entry sites, as well as outlining the current and future experiments that must be completed to show the vaccine's efficacy against infection. 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. 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.* Experiments to be conducted include vaccine transfection into mammalian cells to confirm the ability of the protein to be expressed, enzyme-linked immunosorbent assays to display the capability of the vaccine to elicit both a humoral and cell mediated immune response, and a demonstration of the vaccines capacity to provide effective protection against infection *in vivo*.

CHARACTERIZATION OF *STAPHYLOCOCCUS LUGDUNENSIS* BIOFILMS.

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Staphylococcus lugdunensis, 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. To characterize further, we tested the antibiotic susceptibility of *S. lugdunensis* when grown in a biofilm. Various antibiotic treatments revealed low susceptibility to all of the tested antibiotics, similar to *S. aureus*. To determine whether *S. lugdunensis* biofilms were protein mediated, we compared the susceptibility of the biofilms to proteinase K. Following proteinase K treatment, *S. lugdunensis* biofilms were dispersed, indicating they form protein mediated biofilms. We then set out to identify genetic factors essential for biofilm formation in *S. lugdunensis*. We mutagenized a S. lugdunensis 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. Mutations resulting in high biofilm and low biofilm formers were sequenced to identify genes responsible for the biofilm phenotypes. A mutation within the *S. lugdunensis* surface protein A (slsA) gene was common among all of the low biofilm formers suggesting high expression of this protein is important in biofilm formation. Currently, a genetic knockout is being constructed to confirm these results.

PHOSPHINATE-CONTAINING FLUOROPHORES AS GATED SMALL MOLECULE DELIVERY PLATFORMS.

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Small molecule fluorescent sensors are useful tools for imaging the *in vivo* localization of biologically relevant signaling molecules. Near-infrared (NIR) dyes are of particular interest for this purpose because they absorb at long wavelengths (>650 nm) that have improved tissue penetration depth and are less likely to cause background autofluorescence. We have previously reported a series of NIR dyes, termed Nebraska Red (NR) dyes, that are based on the rhodamine scaffold and contain a phosphinate group at the bridging position. NR dyes demonstrate remarkable photostability and brightness under physiological conditions, making them especially promising for biological applications. We have also demonstrated that spirocyclic thioether derivatives of NR dyes can act as fluorogenic sensors for reactive oxygen species (ROS), which are associated with inflammation pathways involved in human disease. We envision that by attaching functional molecules to the phosphinate group, we can generate a fluorogenic small-molecule delivery reagent that reports upon delivery. Herein we describe a coumarin-NR system that, upon reaction with HOCl, yields both NIR and blue fluorescence as a result of cargo delivery. In the long term, this system provides a scaffold for the gated release of biologically relevant payloads, such as small-molecule drugs.

PEPPERMINT ESSENTIAL OIL *(MENTHA PIPERITA)* AS A NATURAL REPELLENT AGAINST AMERICAN COCKROACHES *(PERIPLANETA AMERICANA).*

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Numerous studies have been conducted over the insecticidal and repelling abilities of plant essential oils. Peppermint essential oil (Mentha piperita) is one of the most popular essential oils purchased by consumers. Nevertheless, investigations into the insecticidal and repelling properties of this oil are lacking. In this study, the objective was to determine if peppermint essential oil can repel American cockroaches (Periplaneta americana) and if so what dilution is needed to do so. Peppermint essential oil was found to repel American cockroaches at 20% and 10% for all animals. To find the minimum percent needed, we ran a number of trials. For each trial, American cockroaches were randomly selected and placed within an aquarium containing a cardboard insert covering the bottom. In one area, the bottom was coated with a specific dilution of peppermint essential oil and vegetable oil. In another area, vegetable oil alone was used to coat the insert. For each trial, we waited 15 minutes after five animals were placed in the aquarium and noted their locations. Results indicate that a 2% solution of peppermint essential oil is the minimum needed to produce a significantly lower repellent effect, an average repellency of 77%, than higher concentrations. The data produced in this study may be useful to insect repellent researchers. The results suggest a product based on peppermint essential oil may be possible against cockroaches. A cockroach repellent product based on a 2% solution of peppermint essential oil would be financially feasible and potentially likely to attract consumer attention.

CHARACTERIZATION OF THE INTERACTION BETWEEN CAF-1 AND PCNA.

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After cellular replication, DNA is tightly wound around histones and condenses into chromatin in a process called replication-coupled nucleosome assembly. This process is mediated by two key proteins: proliferating cell nuclear antigen (PCNA), a DNA sliding clamp protein that functions as a scaffold during the recruitment of proteins in DNA replication, and chromatin assembly factor 1 (CAF-1), a protein that interacts with PCNA and recruit histones to the site of DNA replication. The interaction between these proteins is integral to gene silencing and selective expression. Although this unique interaction has been identified in multiple species, the mechanism by which the proteins function in gene silencing is still unknown. It has been previously demonstrated that the largest subunit of CAF-1, Cac1, is vital for the interaction between CAF-1 and PCNA. Although a PCNA interacting peptide (PIP) motif has been identified on Cac1, we have identified additional sequences within Cac1 that we believe are integral to the interaction with PCNA. We have performed site-directed mutagenesis at each of these sequences in order to elucidate the role of each in the CAF-1-PCNA interaction. Here, we will carry out quantitative protein-protein binding experiments with the Cac1 mutants to determine the binding affinities of each with PCNA. 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.

ACQUISITION RATE OF THE GUT MICROBIOTA IN *DAPHNIA MAGNA.*

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Previous studies have provided considerable insight into the composition and role of the gut microbiota within Daphnia magna. Nonetheless, little is known about how D. magna acquire these

microbes in their early life, specifically the transmission modes and acquisition rate. Previous studies in humans and other model systems show that there is an initial transmission of microbes either immediately or shortly after birth; other studies note that there is continuous variability in the early life microbes due to the environment. In general, the early composition of the gut microbiome has been proven to have considerable effects on the overall host's health throughout their lifetime. Thus, I aimed to study the acquisition rate and the composition of the gut microbiome during early stages of life in D. magna. To accomplish this aim, I exposed offspring to their maternal environment for variable lengths of time, ranging from 0 to 96 hours. Offspring, mothers, and water (the environment for D. magna) were collected and the microbiomes of each were analyzed using 16S sequencing. For this study, I focused on two key questions: what the acquisition rate of the gut microbes is and how does the early life composition of the microbiome in D. magna compare to the maternal microbiome. The results show that gut microbes vary in their acquisition rate as some colonization occurs immediately, but the overall composition varies dynamically over early life. These results provide further insight on the transmission rates of the gut microbiome, which can help us understand how the microbiome can affect population growth, since transmission among individuals is a key process in host-microbe interactions.

CHARACTERIZATION OF TARDIGRADE MICROBIOME.

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The tardigrade, or water bear, is a microscopic organism that can withstand a range of environments, from temperatures near absolute zero to over a hundred times hotter than what the human body can endure to abilities to withstand toxic chemicals and radiation. The resiliency of these organisms is an area of study in regards to human health and how to utilize these protective abilities in our own treatments and therapies. The basic features and characteristics of these animals have become increasingly understood in the last decade, however, the microbiome environment of these resilient animals is still fairly elusive. The Human Microbiome Project has provided crucial information to the human microbiota community and its beneficial role in maintaining a healthy state. With this knowledge, identification of the microbial communities within the tardigrade is important to decipher its role in the organism's abilities. Since the body of tardigrades is near indestructible, our primary focus of present is to determine the most effective method of microbiota extraction and DNA purification from within tardigrades. Commercially purchased DNA isolation kits focus on cultured cells, tissue, and blood which are easily able to manipulate the chosen sample types for DNA extraction. This research uses a variety of kits and protocols to determine the best yield and quality of DNA. The ideal method will then be utilized for genomic sequencing and bioinformatics to characterize the bacterial phylum present within tardigrades in order to gain a better understanding of the microbial community present in these unbreakable micro-animals. Data to be presented. This project was funded by INBRE.

EXAMINATION OF DRONE (UAS) USE FOR SPOTTING CANADA GEESE ON A CENTRAL NEBRASKA LAKE.

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The use of drones (UAS) is becoming more common by hunters, wildlife managers, and hobbyists. One use of drones in Nebraska is to look for game or wildlife. In this study we examined the use of a consumer-level drone to count Canada geese on a lake in Central Nebraska. There are concerns about the use of drones and we wished to see if geese would respond to UAS flying near them. We were able to fly several different drones over a lake in Kearney Nebraska under different weather conditions. Results suggest that Canada geese are less disturbed by white UAS than drones that are orange or black.

While there was wide variance in some results, the geese were not disturbed by drones over 300 feet above the lake. Flying the drone in at lower altitude produced some movement by the geese at between 200 and 650 feet. There are several variables that may be having some effect on these numbers such as cloud cover, temperature, and number of birds present on the lake.

BIOLOGICAL AND MEDICAL SCIENCES

SESSION B

GROWTH KINETICS OF A SUSPENDED CELL ARTHROBACTER AURESCENS TC1 SYSTEM GROWN IN GLUCOSE + ATRAZINE MINIMAL MEDIA.

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Arthrobacter aurescens TC1 is a possible bacterial strain for use in bioremediation of atrazine-contaminated groundwater. Developing these technologies requires quantitative growth kinetics data so that bioreactors can be designed for optimal operation. In this investigation, the growth kinetics of suspended cell Arthrobacter aurescens TC1 was evaluated in a glucose minimal media. To assess the effects of Arthrobacter aurescens TC1 on Atrazine, growth curves were evaluated at varying levels of Atrazine and glucose. The experiments were performed under constant temperatures and monitored over time for a growth curve to be determined from optical density measurements. This data will be used to determine an appropriate growth kinetics model.

DECREASED TRICARBOXYLIC ACID (TCA) CYCLE ACTIVITY IN *STAPHYLOCOCCUS AUREUS* INCREASES SURVIVAL TO INNATE IMMUNITY.

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Staphylococcus aureus is a gram positive bacterial species that is responsible for over one million infections a year. A major concern regarding *S. aureus* infections stems from failure to respond to antibiotic therapy. One hypothesis for this phenomenon is persister cell formation. Persister cells are a subtype of dormant cells that have a high tolerance to antibiotics making them harder to treat in a medical setting. Recent work demonstrated that persisters form when low intracellular ATP is present. Specifically, when the tricarboxylic acid (TCA) cycle is disrupted an increase in antibiotic tolerance is observed. We hypothesized that persisters not only were problematic for antibiotic treatment but also to components of innate immunity that resemble antibiotics in function (antimicrobial peptides). Previous experiments showed that when the TCA cycle gene, fumC, was disrupted, a higher tolerance to antimicrobial peptides was observed. Other components of innate immunity were then tested. Preliminary studies revealed the fumC mutant had higher survival than wild type *S. aureus* within macrophages. To discern the underlying mechanism for this phenotype, reactive oxygen species, reactive nitrogen species, and pH were examined more closely. Early results suggest the fumC knockout is better able to withstand the reactive oxygen stress at an acidic pH compared to wild type *S. aureus*. The role of reactive nitrogen species was less conclusive and will be examined further.

IDENTIFICATION AND VALIDATION OF FBXO9 INTERACTING PROTEINS IN ACUTE MYELOID LEUKEMIA.

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Acute myeloid leukemia (AML) is a devastating cancer caused by abnormally proliferating myeloid cells originating in the bone marrow. Typically, genomic aberrations lead to disease initiation, prevention of myeloid differentiation, and proliferation. Although AML represents 30% of diagnosed leukemias, it accounts for 40% of leukemia-related deaths and thus it is vital to understand the underlying mechanisms of this disease. A less extensively studied aspect relating to AML is the ubiquitin proteasome system (UPS), which targets proteins for degradation by a substrate-recognizing E3 ligase. Previous studies have shown that the E3 ligase FBXO9 displays decreased expression in AML patients potentially leading to a more aggressive phenotype. However, FBXO9 substrates in AML are currently unknown, making it a clear priority to identify and characterize such substrates. Through mass spectrometry analysis, we identified Pumilio RNA-binding family member 1 (PUM1) as a potential substrate in leukemic cells derived from FBXO9 knockout mice. We hypothesize that PUM1 is a substrate of FBXO9 in AML. Accordingly, we tested PUM1 degradation by the UPS and showed that 293T and AML cell lines treated with the proteasome inhibitor MG132 led to accumulation of PUM1. Additionally, we immunoprecipitated PUM1 from AML cells and used mass spectrometry analysis to identify components of the proteasome, further supporting the idea that PUM1 is degraded by the UPS. Additionally, we identified novel ubiquitination and phosphorylation sites within PUM1 with potential for FBXO9 substrate interaction and for a poly-ubiquitin chain resulting in degradation. Furthermore, an Ingenuity Pathway Analysis of the top 140 proteins identified via mass spectrometry suggested that PUM1-associated proteins share involvement in multiple cancer-related pathways, including cell death and survival and hematological disease. Our data support the role of PUM1 as a potential FBXO9 substrate and therapeutic target, and will aid in the identification of additional proteins contributing to AML.

PROBING ASTROCYTE FUNCTION IN FRAGILE X SYNDROME USING HUMAN PLURIPOTENET STEM CELL-DERIVED ASTROCYTES.

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Fragile X syndrome (FXS) is an X linked neurodevelopmental disorder related to intellectual disability and the most common monogenic cause of autism spectrum disorder. FXS results from an expansion of CGG repeat in the 5'-untranslated region of FMR1 gene, leading to the absence of fragile X mental retardation protein (FMRP), an mRNA binding protein. Recently, the absence of FMRP in astrocytes has been implicated in structural and functional synaptic deficits in FXS mouse models. However, the contribution of human astrocytes to such impairments remains unclear. To investigate whether astrocyte dysfunction contributes to the pathogenesis of FXS, we generated a human-based FXS model via differentiation of human induced pluripotent stem cells (hiPSC) to astrocytes. We observed delayed developmental pattern from immature to the mature stage in FXS derived astrocytes with altered expression of astrocytic proteins. FXS astrocytes also have altered functional properties displaying enhanced ATP-induced calcium signaling. In ongoing experiments other canonical astrocyte function such as glutamate uptake capacity as well as regulation of synaptogenesis is being investigated. To examine the phenotypes of FXS astrocytes *in vivo*, we generated chimeric mouse brains by neonatal implantation of FXS and control hiPSC-derived immature astrocytes. The transplanted human astrocytes

expressed the astrocyte markers, exhibited morphology distinct from the human astrocytes in culture and acquired the long and complex processes in the mouse brain 3 months post engraftment. We are currently examining the astrocyte morphologies, their distribution in different regions in the mouse brain and their effect on structural synaptic plasticity *in vivo*. Our studies suggest a role of human astrocytes in FXS pathogenesis and provide therapeutic targets for the personalized FXS treatment.

PERSISTER FORMATION IN *STAPHYLOCOCCUS EPIDERMIDIS* CLINICAL ISOLATES.

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Staphylococcus epidermidis is a commensal organism, often found within the exterior microbiota of mammals. Robust *S. epidermidis* biofilms often form in healthcare settings causing chronic infection mediated through indwelling of medical devices which is further exaggerated due to the target population consisting of immunocompromised individuals. These chronic conditions can be explained by a subpopulation of dormant cells, known as persisters, growing within a biofilm. Recent work has determined that screening *S. epidermidis* clinical isolates following vancomycin challenge can provide information as to whether an isolate is a relatively high persister former or low persister former. To identify a specific mechanism for persister formation in *S. epidermidis*, bacterial cells were mutagenized with ethyl methylsulfonate (EMS). Following EMS treatment, enrichment for high persister isolates was performed and candidates were sent for whole genome sequencing.

FDA-APPROVED DRUGS ADMINISTERED IN COMBINATION AS TREATMENT AGAINST CHRONIC *TOXOPLASMA GONDII* INFECTION.

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The apicomplexan parasite *Toxoplasma gondii* is able to infect virtually all warm-blooded animals and is estimated to infect up to 30% of the human world population. The chronic stage of infection, in which the parasite resides as intracellular cysts in host muscles, organs, and the brain, is lifelong and currently has no treatments available to alleviate infection. Chronic infection is thought to be asymptomatic in immunocompetent individuals, although more studies have begun to look at associations between chronic *T. gondii* infection and neurobehavioral disorders such as schizophrenia, bipolar disorder I, and obsessive-compulsive disorder. Several FDA-approved drugs have been shown to significantly decrease *T. gondii* cysts in hosts, but none of the drugs have completely eliminated infection when administered alone. The goal of this study was to evaluate combinations of FDA-approved drugs against chronic *T. gondii* infection in order to completely eradicate the chronic cyst stage of infection or decrease cyst burden more than previously described. We hypothesized that we could significantly reduce cyst burden in *T. gondii* chronically infected mice by combining FDA-approved drug treatments that have shown efficacy against *T. gondii* infection.

ELUCIDATION OF THE NOVEL ANTIPARASITIC TARGET ROP1 FROM AN INTEGRATED FORWARD GENETIC SCREEN IN *TOXOPLASMA GONDII*.

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Toxoplasma gondii is an apicomplexan parasite believed to infect 25-30% of the global population. Most exposed individuals experience mild symptoms or are virtually asymptomatic; however, severe clinical presentation occurs in patients with compromised immune systems and in the fetuses of pregnant women exposed to *T. gondii*. The propensity for serious adverse reactions or

undesirable long-term effects following the use of the current therapeutic regimen has prompted further efforts toward developing improved pharmaceuticals to combat this infection. An experimental compound, benzoquinone hydrazone (KG8), was previously demonstrated by our laboratory to reduce acute parasite burden *in vitro* and *in vivo*. However, despite the efficacy of this compound, no mechanism of action was known; thus, we aimed to determine the putative target of KG8 in *T. gondii*. Our method involved the use of random chemical mutagenesis with ethyl methanesulfonate and a subsequent, gradual increase in compound pressure to facilitate selection of resistant parasite populations. Following clonal isolation and evaluation of phenotypic differences between putative clones, significantly resistant populations were subjected to whole-genome sequencing and analyzed for mutations conferring resistance through the use of an in-house bioinformatics pipeline. Results of this analysis indicated that a single nonsynonymous C→T transition (P207S) in the gene encoding the secreted protein ROP1 led to a 6.3-fold increase in the IC50 of KG8 in mutant populations relative to the parent strain. Generation of additional mutations near this locus through error-prone PCR hypermutagenesis enhanced the observed resistance to 12.6-fold that of the parent strain. Subsequent *in silico* analyses provided evidence for putative low-energy binding interactions between ROP1 and KG8, and, further, predicted a previously-unreported phosphotransferase domain within this highly-disordered protein. In sum, these data provide evidence for the use of ROP1 as a novel and parasite-specific pharmaceutical target against *T. gondii.*

ANTIBACTERIAL EFFECTS OF ESSENTIAL OILS ON A BACTERIAL STRAIN ISOLATED FROM A PATIENT WITH STASIS DERMATITIS.

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Due to the over prescription of antibiotics, antibiotic resistance has become one of the greatest threats to human health, and it is estimated that by 2050, over 10 million lives will be lost annually due to antibiotic resistant bacteria. To combat this issue, many patients are turning to alternative sources, like essential oils, as a way to treat bacterial infections without resorting to the use of antibiotics. However, despite their growing popularity, there is still limited information and research on the actual benefits of these oils. For this study, we isolated a bacterial strain, KRPL5 identified as *Staphylococcus epidermis*, from a patient exhibiting a stasis dermatitis flare. To determine the susceptibility of the isolated organism to essential oil treatment, we did a series of disc diffusion assays using the following essential oils: lemongrass (control), lavender, oregano, cinnamon, and coconut oil. Results indicated that all oils except coconut oil were effective at inhibiting bacterial growth. Minimum inhibitory concentrations were measured for the four oils that showed zones of inhibition and compared to our control. Results indicated that both cinnamon and oregano oil are highly effective at inhibiting bacterial growth while lavender oil was less effective. Taken together, these results indicate the potential use of both cinnamon and oregano oils as a topical antibacterial alternative. Future studies should include testing of these oils on different strains of bacteria, especially those commonly found on the skin, and testing different brands of these oils, since the production of essential oils is not as strictly regulated as the production of antibiotics. Additional tests could also be performed to determine the benefits of using these oils in combination with antibiotics.

EXPRESSION OF VIR-1 AND VAGO IN NORA VIRUS *INFECTED DROSOPHILA MELANOGASTER* HEMOLYMPH.

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The Drosophila melanogaster immune system serves as a valuable model to identify, study, and compare similar components found in humans. Analysis of the D. melanogaster immune response to

viral infection can be used to inform future immunity research and applications to human innate immunity. Two D. melanogaster proteins, Vago and Virus-induced RNA 1 (Vir-1), have been identified as candidates for analysis due to their upregulation in response to viral infection. The role of these proteins is uncharacterized in Nora virus-infected D. melanogaster. Nora virus replication is localized within the gut of D. melanogaster, but whether or not it circulates to other organs is unknown. While the complete pathology of Nora virus is not known, a locomotor defect is under investigation in our lab. This led us to hypothesize that Nora virus, Vago, and Vir-1, are circulating in the hemolymph of Nora virus infected D. melanogaster, allowing for virus migration to tissues beyond the gut and a conferred immunity in other tissues. To address this, we performed Western blot analysis on whole body and hemolymph collected from Nora virus infected and uninfected control D. melanogaster. The western blot analysis of Nora virus infected D. melanogaster demonstrates the presence of Vago, Vir-1, and Nora virus capsid protein, VP4b, in the hemolymph. This new finding may provide a link to effects seen in other tissues including the possible locomotor defect. The project described was supported by grants from the National Center for Research Resources (5P20RR016469) and the National Institute for General Medical Science

THE ROLE OF THE OAZ1 RNA IN CONTROLLING GENE EXPRESSION.

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Riboswitches are segments of messenger RNA (mRNA) that bind to specific cellular metabolites and regulate gene expression. Riboswitches are defined based on the following criteria: the RNA binds specifically to one metabolite, exhibits conformational changes induced by metabolite binding, and influences gene expression in a metabolite-dependent manner. Although nearly all discovered riboswitches are in bacteria, fungi, and plants; we have identified a putative mammalian riboswitch. The mouse Ornithine Decarboxylase Antizyme 1 (Oaz1)-pseudoknot (PK) RNA appears to bind specifically to spermine, exhibits spermine-dependent conformational changes, and influences spermine-dependent expression of Oaz1, an inhibitor of spermine biosynthesis. This work aims to investigate the role of the Oaz1-PK RNA in controlling gene expression in the presence of various polyamines. The function of Oaz1-PK RNA as a spermine-dependent riboswitch regulating expression of Oaz1 provides a potential target for affecting a metabolic process key to cancer cell growth and proliferation. 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.

STRUCTURAL ANALYSIS OF OAZ1 RNA IN CRASSOSTREA GIGAS.

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Riboswitches are segments of non-coding RNAs that bind cellular metabolites in order to modify expression of a downstream gene. Specifically, a riboswitch interacts with a precise ligand resulting in a conformational change in the RNA. This structural change can affect transcription, translation or RNA processing of the downstream gene, which would make more metabolite, thereby affording an elegant feedback mechanism of inhibition. The Soukup lab is investigating a potential mammalian riboswitch (OAZ1-PK RNA) that is involved in polyamine biosynthesis. Polyamines are essential for cell growth and differentiation, and play a role in replication, transcription, and translation. The ability of riboswitches to control essential metabolic pathways has opened up the possibility that

novel antibiological agents could eventually be synthesized that target riboswitches. The OAZ1-PK RNA is highly conserved across a variety of organisms; suggesting RNA might have played a key role in early organisms. Riboswitches could provide a key explanation of how RNA might have functioned in roles now held by proteins. Further research is still needed to both confirm the presence of riboswitches in these organisms and to gather more data regarding their structure. This project is focused on studying the riboswitch-ligand binding interaction of OAZ1 RNA (from oyster, Crassostrea gigas) with the metabolite spermine. Preliminary evidence has been obtained using in-line probing and equilibrium dialysis that the oyster OAZ1 RNA undergoes structural changes in the presence of spermine, which is a key characteristic necessary to classify an RNA as a riboswitch. 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.

A SCREEN OF CHROMATIN ARCHITECTURAL PROTEINS WITH HISTONE MODIFICATION PARTNERS FOR INSULATOR ACTIVITY IN *SACCHAROMYCES CEREVISIAE.*

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One mechanism cells use to regulate gene expression is modifying the degree of DNA compaction. Genes found in regions of tightly compacted heterochromatin tend to be silenced, while genes in loosely organized euchromatin tend to be readily expressed. The repressive histone markers that cause sequences to condense into heterochromatin have a propensity to spread down chromatin fibers. The boundary between these regions is determined by binding sites for insulator proteins. Although a number of these proteins have been identified in various model systems like *S. cerevisiae* and D. melanogaster, the only mammalian protein thus far shown to have insulator activity is CTCF. CTCF and other chromatin architectural proteins such as Satb1 and Satb2 cause wide-ranging reorganization of DNA. Our research aims to test whether these other human chromatin architectural proteins can serve as an insulator in yeast if they are co-expressed with human histone modification proteins that they usually interact with. Our insulator assay tests whether specific recruitment of the candidate protein can activate a gene located in a sub-telomeric region, which is normally silenced by the telomere position effect. A protein with insulator properties will shelter this gene from heterochromatin, while a non-insulator protein will have no effect on the gene's expression.

ACTIVATION OF IMMUNE CELLS AS THE MECHANISM OF ACTION OF ANTISCHISTOSOMAL COMPOUND SAS1.

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The neglected tropical disease schistosomiasis causes vital organ damage and has one of the highest incidences of parasite-related mortality worldwide. The currently available treatment Praziquantel has efficacy only against the adult worm. A newly discovered antischistosomal compound SAS1 has shown efficacy *in vivo* against juvenile and mature parasites in both murine and primate models. However, SAS1 kills the parasite outside of its host only at extremely high concentrations, indicative of a host-dependent mechanism of action. It is hypothesized that SAS1 facilitates the activation of the host immune system, specifically priming murine eosinophils to undergo increased levels of degranulation. Eosinophilic degranulation is measurable by a release in the granulocytic proteins eosinophil peroxidase and superoxide anions. In this study, male mice were orally administered SAS1 or vehicle control. Splenocyte suspensions were obtained and stimulated with secretagogue. Eosinophil peroxidase levels were determined by enzyme-linked immunosorbent assay and superoxide

anion concentrations were measured by calculating the reduction of cytochrome c. Preliminary results reveal that the experimental drug increased innate immune cell degranulation following low levels of stimulation. This work and future studies may progress the release of SAS1 as a clinical treatment for schistosomiasis in order to combat resistance to Praziquantel and introduce treatment early in infection.

DETERMINATION FOR ENHANCED YIELDS OF *PSEUDOMONAS AERUGINOSA* PERSISTER CELL POPULATION AFTER THE TREATMENT OF VARYING ANTIBIOTICS.

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Pseudomonas aeruginosa (P. aeruginosa) biofilms are found to have a small subpopulation of cells called persister cells. These cells are able to withstand antibiotics by entering a dormant state in the presence of a stressor and once the stressors are removed, cells are able to resume growth reestablishing a bacterial community. P. aeruginosa secrete a quorum sensing molecule known as pyocyanin (PYO), that has previously been found to influence persister cells populations. In this study, King A media was used as a rich media known to promote PYO production. Furthermore, tryptic soy and King A agar was used to grow P. aeruginosa strain PAO1 with green fluorescent protein (PAO1-GFP). Cultures were grown in King A media and treated with varying concentrations of two antibiotics, ciprofloxacin and carbenicillin. Persister cell populations were determined in each condition by CFU counting to determine conditions with high yields of persister cells.

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

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The tetrapyrrole biosynthetic pathway produces important biological products such as hemes, chlorophylls, siroheme, and cobalamin. After the initial production of 5-aminolaevuilinic acid (ALA) in the first step of the pathway, two ALA molecules are combined together by 5-aminolaevulinic acid dehydratase (ALAD) to produce porphobilinogen, a structural piece used to create the basic tetrapyrrole structure characteristic of the hemes and chlorophylls. Notably, much is still not understood about the enzymes that construct this pathway, including ALAD, which is responsible for several life threatening and poorly understood disorders. The purpose of this study was to clone, express, and characterize the activity of ALAD from *E. coli* with respect to its associated cofactors in order to lay the foundation for future studies of this enzyme.

CHANGING ANKLE STIFFNESS TO ADAPT TO DIFFERENT MECHANICAL DEMANDS.

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The ankle structures play a key role in body support, forward propulsion and leg swing. One important property of the human ankle is its 'quasi-stiffness', or resistance to angular motion. The ankle joint stiffness can play a role in aiding the lower leg as its rocks over the foot. Human biological ankle stiffness changes in response to changes in the mechanical demands of walking (e.g. added load or changes in speed), using active muscle contractions. However, the role of ankle stiffness in regulating metabolic energy across walking conditions is unknown. Therefore, the purpose of this study is to see how the ankle stiffness of an assistive device affects energy expenditure during locomotion with different mechanical demands (e.g. carrying additional loads). Participants wore an immobilizer boot with a distally-attached unilateral ankle-foot prosthesis emulator that simulated various stiffnesses of perfectly elastic springs. Each individual walked for 6 minutes at 2 different loading conditions (with

and without 30% body mass), and 5 stiffness conditions: the typical human ankle stiffness, and ±20% and ±10% of that value. The energy consumption increased when carrying additional load ($p=0.001$) and the trend was for higher stiffness to provide greater metabolic benefit with added load ($p=0.06$). These preliminary data suggest that the ability to vary ankle stiffness while walking may be important when seeking to minimize metabolic power in walking tasks of varied demand (such as carrying additional loads). These results can be translated into the design of space suits. Changing the stiffness will allow the wearer to minimize the effort needed to move while wearing the space suit in different gravity conditions here on Earth and in space. This principle can also be used in rehabilitation once the astronauts returns from a reduced gravity environment, by changing the ankle stiffness to reduce their energy expenditure.

BIOLOGICAL AND MEDICAL SCIENCES

SESSION C

DRIVING FORCES STABILIZING CELLULAR PRION PROTEIN (PRPC)MONOMERS AND DIMERS ON THE CELL SURFACE.

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The conversion of the prion protein PrPC to its infectious form PrPSc via autocatalytic misfolding is critical to the development of a group of neurodegenerative diseases known as transmissible spongiform encephalopathies (TSEs). In order to understand the factors that influence the PrPC to PrPSc conversion, it is pertinent to identify how PrPC interacts with its environment. PrPC is anchored to the extracellular side of the lipid bilayer via glycosylphosphatidylinositol (GPI) and can be found in monomer or homodimer form. We investigated the driving forces that stabilize PrPC monomers and dimers on the cell membrane surface using molecular modeling techniques. From our analysis, we identified stable dimer conformations and characterized the dimer interface using residue interaction network analysis and residue contact maps. We then executed a series of molecular dynamics simulations to examine the differences in the protein-membrane interface between PrPC monomers and dimers, both GPI-anchored and unanchored. Our results indicate that PrPC dimers are stabilized by hydrophobic interactions along the β-sheets. The stability of the protein-membrane interface is affected by the orientation of PrPC α-helices on the cell membrane surface. We discovered that GPI anchoring, in combination with PrPC dimerization, restricts the mobility of the protein on the membrane surface. We propose that PrPC dimers with hydrophobic interfaces inhibit PrPSc propagation due to the orientational constraints that GPI anchors place onto the dimer structures that do not allow the presentation of a PrPSc binding domain. 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.

POLYMORPHISMS MODULATE SHEEP PRION PROTEIN SUSCEPTIBILITY TO MISFOLDING BY ALTERING THE LOCAL RESIDUE NETWORK OF INTERACTIONS.

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The autocatalytic misfolding of the cellular form of the prion protein, PrPC, to the infectious form, PrPSc, is critical to the development of prion diseases. Though the mechanism for this misfolding is not well understood, previous research recognizes the role of genetic mutations in varying susceptibilities to prion diseases in sheep. Using structural bioinformatics techniques, our study

examines the residue interactions in three different sheep PrPC structures. These structures contain different point mutations and have different levels of susceptibility to scrapie prion disease. To examine local structural differences around the mutations of interest, we examined residue networks, surface electrostatics, solvent exposure, hydrophobicity, and beta sheet formation propensity. Our results indicate that mutated residues modulate the local network of interactions. We will discuss how the local changes may impact initial protein misfolding. 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.

INVESTIGATING THE STRUCTURAL EFFECTS OF POINT MUTATIONS ON ACETYLTRANSFERASES BY COMPUTATIONAL METHODS.

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Enzymatic acetylation is a process that is mediated by acetyltransferases where an acetyl group is transferred from acetyl-CoA to a target protein. Protein acetylation is known to affect many biological processes such as homeostasis, metabolism, transcription factor function, protein-protein interactions, protein stability, and enzyme activity. The goal is to successfully change the active site of Naa50p to carry out the functions of Alpha-TAT and understand the biochemical and structural characteristics of acetyltransferases to lead to the development of new therapies for acetyltransferase-related diseases. Understanding what confers specificity to this enzyme family will allow us to investigate their binding patterns and overall function and activity. In order to identify and test structural features in acetyltransferases that could oversee specificity, three single point mutations were done using Naa50p to change the active site to resemble the active site of Alpha-TAT. Since Naa50p is an N-terminal acetyltransferase, we want to test if we can change the specificity to that of a lysine acetyltransferase (Alpha-TAT). Previous studies suggest that the mutant Naa50p should show more activity towards Alpha-TAT substrates and less activity towards Naa50p substrates. To provide an atomic view of the structural effects of mutations on the initial structures, we performed structural bioinformatics analysis. We found that there were no major structural differences after point mutation, but the local mobility of the protein structure changes. We also found that conformation of Naa50p is more sensitive to point mutations than Alpha-TAT. Although the local interactions change slightly, most point mutations are not key for the overall folding of the enzyme.

OPTIMIZATION: UTILIZING SIRNAS TO KNOCKDOWN ARGONAUTE GENE FAMILY AND DETECTION OF BOVINE MIRNAS.

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Exosomes are extracellular vesicles present in all eukaryotic fluids and contain cargos of biologic significance, especially miRNAs and proteins. Exosomes have been shown to modulate host gene expression and it has been shown that humans absorb milk exosomes and deliver them to peripheral tissues. The Argonaute protein family plays an important role in RNA silencing, primarily as being the main component of the RNA-induced silencing complex (RISC). Single stranded miRNAs become incorporated and serve as a template to recognize complementary mRNA that will be cleaved by the Argonaute proteins. Our hypothesis is that bovine miRNAs contained in bovine milk exosomes become incorporated into human cells and are utilized the RISC pathway to modulate human gene

expression. In order to determine whether bovine milk exosomal miRNAs become incorporated into RISC, a siRNA knockdown of the Argonaute gene family must occur. By knocking down the each of the four Argonaute alleles separately, it can be determined which Argonaute protein is mainly associated with the effects of bovine miRNAs. In addition, to determine that bovine miRNAs are in human miRISC complexes, Stem-Loop PCR and subsequent rh-PCR can be used to distinguish human and bovine miRNAs that differ by one nucleotide. This presentation will discuss the reverse transfection optimization of Argonaute siRNAs as well as detection of miRNAs via Stem-Loop PCR. 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.

ADIPOSE TISSUE RENIN-ANGIOTENSIN SYSTEM AND SYSTEMIC HYPERTENSION.

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Objectives: Central adiposity, in particular the accumulation of intra-abdominal visceral fat, has been linked to adipose tissue dysfunction and obesity-related diseases including hypertension and atherosclerosis, however regulatory mechanisms are poorly understood. We hypothesized that increased micro-vascular tone and abnormal peripheral vascular resistance, specifically in visceral adipose tissue, may contribute to obesity related hypertension. Methods: In 62 obese subjects (age 42±10 yr, BMI 42±3 kg/m2) undergoing elective bariatric surgery, we characterized vaso-contractile responses of isolated adipose tissue arterioles using videomicroscopy and examined relevant gene expression between obese normotensive (O) and obese hypertensive (OH) using qPCR. Also, blood level and adipose tissue secreted angiotensinogen, angiotensin II (AngiII) and Angiotensin converting enzyme (ACE) were assessed. Results: Visceral arterioles exhibited significantly greater AngiII-mediated vasoconstriction by 20% in OH (SBP 146±8 mmHg) compared to O (SBP 118±5 mmHg) ($p<0.05$). Additionally, blood level of ACE and AngiII were significantly greater in OH compared to O. Visceral adipose tissue (VIS) secreted greater amount of ACE and AngiII compared to subcutaneous adipose tissue (SC). ACE mRNA expression was significantly increased in OH compared to O (3-fold, $p<0.05$). In contrast, vasopressor responses to other agonists including endothelin-1 and phenylephrine were not different between fat depots or subjects with or without hypertension. Conclusion: The findings demonstrate differential activation of the renin-angiotensin system (RAS) in the visceral adipose tissue microvasculature that may contribute to mechanisms of obesity-related systemic hypertension. RAS targeting, in particular, may provide incremental clinical benefit in treating obesity-related hypertension.

EFFICACY OF PAN-PARASITIC EXPERIMENTAL COMPOUNDS AGAINST *TOXOPLASMA GONDII* IN BOTH *IN VITRO* AND *IN VIVO* MODELS.

Austin Sanford*, Ryan Grove, Alexander Wallick, Rosalie Warner, Gabrielle Watson, Xiaofang Wang, Jonathan L. Vennerstrom, and Paul H. Davis, University of Nebraska Medical Center, Omaha, NE 68198

Toxoplasma gondii is an obligate intracellular parasite that has infected nearly 60 million individuals in the United States alone. Acute infection causes ill and potentially lethal effects to immunocompromised individuals, and developing fetuses when mothers become infected during pregnancy. The aim of this research was to screen a family of experimental compounds that had previously been shown to be active against a panel of apicomplexan and helminth parasites for activity

against acute *T. gondii* infection. Both an *in vitro* and murine *in vivo* models were utilized to determine overall efficacy of these compounds, potential host cell toxicity, and to drive further design and synthesize of derivative compounds. Three highly potent and selective compounds were evaluated for success in clearing a lethal acute infection of a murine model. One compound was successful at permitting 100% survival with no apparent toxicity or subsequent ill effects, indicating successful clearance of a lethal acute infection. Further classification of the compound will be performed to determine possible mode of action as well as new compound derivatives to be evaluated.

CHARACTERIZATION OF SHEEP IFITM3 AS A RESTRICTION FACTOR OF SMALL RUMINANT LENTIVIRUS.

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Small Ruminant Lentivirus (SRLV), infects goat and sheep species, causing chronic respiratory and nervous system disease. This group of viruses includes Maedi-Visna Virus (MVV), known to infect sheep species, and Caprine Arthritis-Encephalitis Virus (CAEV), known to infect goat species. Due to the ability of SRLV to integrate its genome into the host's genome and through the mechanism of reverse transcription, the resulting infection is persistent, leading to an increase in genetic diversity of the virus. Interferon Transmembrane Proteins (IFITMs) have been shown to inhibit HIV and other lentiviruses by impairing viral infectivity in newly formed viruses. Because of the demonstrated ability of IFITMs to restrict or inhibit viruses, like HIV and SIV, we have begun to explore IFITMs as potential restriction factors of SRLV. Investigating the ability of IFITM proteins to restrict SRLV infection is important because of its role as an agricultural pathogen and its similarity to HIV. We hypothesize that the overexpression of sheep IFITM3 will inhibit SRLV infection in vitro. This presentation will describe the development of assays and preliminary data exploring this hypothesis.

POSSIBLE PATHOGENIC EFFECT CAUSED BY NORA VIRUS INFECTION IN *DROSOPHILA MELANOGASTER.*

Lesley Towery*, Amanda McCown, Abigail Benz, Devyn Crisman, and Kimberly A. Carlson, Department of Biology, University of Nebraska at Kearney, Kearney, NE 68849

Nora virus is a picorna-like virus that contains a positive-sense, single stranded RNA genome. The virus infects Drosophila melanogaster with no known pathogenic effects. One hypothesized pathogenic effect of Nora virus is a deficit in locomotor ability of the fly. In this study, geotaxis assays and longevity curves were used to determine if Nora virus infection has an effect on D. melanogaster's locomotor ability. Quart sized cages (five Nora virus infected, five Drosophila C virus (DCV) infected, and five uninfected) were established each containing 60 virgin female flies. The cages were marked with a line two thirds from the bottom of the cage. Every third day since cage establishment, the flies were tapped to the bottom, allowed one minute to reach the top, and the number of flies crossing the threshold line were recorded. Also on every third day, the dead flies were removed, the number recorded, longevity curves were created and examined using Kaplan-Meyer survivorship analysis. The data demonstrated a significant decrease in both geotaxis and longevity when the D. melanogaster were infected with either Nora virus or DCV, as compared to uninfected controls. This is the first time that a possible phenotype has been associated with Nora virus infection. Overall, the data demonstrate that geotaxis and locomotor dysfunction may be a pathogenic hallmark of Nora virus infection. 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.

EFFECTS OF CURCUMIN ON THE NF-κB PATHWAY IN TRIPLE NEGATIVE BREAST CANCER.

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Triple negative breast cancer is an aggressive form of breast cancer which does not depend on estrogen or progesterone for growth and lacks upregulated Her-2 receptors. This cancer is resistant to most current breast cancer treatments due to the mutation profile, and alternative treatments are lacking. Development of new therapies is needed. Curcumin, a chemical extract of the spice turmeric, has demonstrated anti-inflammatory properties and shows promise as a treatment for several inflammatory conditions, possibly including triple negative breast cancer. Previous studies demonstrated marked curcumin-caused cancer cell death in cultured cells. Additionally, curcumin has been used effectively as an adjuvant in conjunction with conventional chemotherapies to combat chemotherapy induced inflammation and prosurvival signaling in cancer. However, the exact mechanism by which curcumin influences cancer cell survival is not well known. This study explores interference with IKKβ in the proinflammatory and prosurvival NF-κB pathway as a possible mechanism. In this study survival of triple negative breast cancer cells (MDA-MB-231) with variable curcumin treatment (0-50μM) was evaluated by MTT assay and effects on the NF-κB pathway were demonstrated by western blot analysis. Treatment of triple negative breast cancer cells with 50μM curcumin decreased cell survival by 88% after 48 hours of treatment compared to untreated triple negative breast cancer cells ($p<0.01$) shown by MTT analysis. Additionally, through western blot analysis both NF-κB and IKKβ proteins demonstrated decreased levels after 24 hours of treatment with 25μM curcumin. These results suggest that curcumin may hinder cancer cell survival through inhibition of the proinflammatory and prosurvival NF-κB pathway, possibly through regulation of IKKβ.

HIGH GLUCOSE CONDITIONS AFFECT PHYSICAL CHARACTERISTICS OF BREAST CANCER CELLS AND INCREASES PROLIFERATION THROUGH POLYAMINE PATHWAY.

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Background and Hypothesis: Hyperglycemia is known as a source for increasing cancer cell proliferation and furthering metastasis. Increased blood sugar levels are known to reduce the effects of cancer therapeutics. Polyamines (putrescine, spermine, and spermidine) are ubiquitous in cells and are known to be involved in vital processes such as cell growth, replication, and transcription. Polyamines have also been shown to have increased levels in cancers such as colon and skin. We hypothesized that polyamines are involved in proliferation of breast cancer cells under diabetic conditions. Furthermore, diabetic states affect mechanical properties such as cellular elasticity in cancer cells, which can further exacerbate proliferation and induce invasion. Methods and Results: Cell lines used in this study included MDA-MB-231 (late stage breast cancer) and MCF-10A (normal breast epithelial cells). Cells were treated with normal glucose (NG, 5mM) or high glucose (HG, 25mM) in the presence and/or absence of polyamine synthesis inhibitors. Mechanical properties of the cells were monitored using atomic force microscopy (AFM) under different treatments of glucose. HG treatments increased cell proliferation in both cell lines. However, treatments in the presence of ornithine decarboxylase (polyamine synthesis enzyme) inhibitor, difluoromethylornithine (DFMO) prevented this increase in cell proliferation. DFMO was also able to decrease the spermidine levels with glucose treatments. AFM showed breast cancer cells have a smaller modulus of elasticity (22.1kPa) versus the normal breast epithelial (46.9kPa) under NG conditions. HG conditions reduced the elasticity in both cell lines with the cancer cell line still having the smaller modulus. Conclusion: Polyamine synthesis pathway is involved in normal breast epithelial and breast cancer cell proliferation under HG. The

physical characteristics (elasticity) between breast cancer cells and normal epithelial cells are distinguishable. These methods help provide a better understanding for the role of diabetes in proliferation and invasiveness of breast cancer cells.

PLATELET MEDIATED RESCUE OF PANCREATIC CANCER CELLS IN ANCHORAGE-INDEPENDENT CONDITIONS.

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The vast majority of pancreatic cancer patients are diagnosed after the primary tumor has metastasized to distant sites leading to poor patient outcomes. The survival of circulating tumor cells (CTCs) is essential to establish the metastatic lesions, but anchorage-independent conditions encountered by the CTCs can potentially initiate a programmed cell death called anoikis. The mechanisms by which CTCs subvert anoikis are not well understood. However, platelets are suggested to play a critical role in the cancer cells survival during hematological dissemination. Upon activation by the cancer cells, platelets release a variety of angiogenic molecules and growth factors, which CTCs may use to avoid anchorage-independent induced cell death. In this study, cancer cell-platelet interactions were evaluated using ADP activated platelets and multiple pancreatic cancer cell lines exposed to anchorage-independent conditions. The physical interaction of platelets with cancer cells was investigated using phase-contrast microscopy; survival of cells in anchorage-independent conditions was appraised using MTT and flow cytometry, and biochemical events resulting from cancer cell-platelet interaction was investigated through western blot analysis. Exposure of cells to anchorage-independent conditions showed an inverse relationship between the percentage of viable cells and time spent in low attachment. Treatment of pancreatic cancer cells with activated platelets augmented relative cell survival by 40% compared to cancer cells alone ($p<0.05$) in a time and dose dependent manner. Finally, western blotting demonstrated that platelet treated cells had increased activation of ERK1/2 compared to untreated cells. These results suggest that platelets biochemically interact with pancreatic cancer cells exposed to low attachment conditions thereby conferring a survival benefit.

IDENTIFYING THE MOLECULAR TARGET OF ANTITOXOPLASMA COMPOUND SW33.

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As antimicrobial drug resistance continues to increase, there lies an urgent need for the development of novel, efficacious drug treatments. When antimicrobial drugs are developed, their mode of action (MOA) is often identified before they become potential candidates for clinical use. Determining the MOA is important as it demonstrates the function of the drug at the cellular level and exposes potential risks for toxicity. One method to determine the MOA, termed chemical mutagenesis, consists of the induction of drug resistance *in vitro* followed by examination of the resistant population's genomes to identify which genes are conferring resistance. In this work, I utilize the ubiquitous parasite *Toxoplasma gondii* to explore a novel method of double mutagenesis with the goal of determining the MOA of pan-parasitic compound SW33, a drug that has shown efficacy against both *T. gondii* and the causative agent of malaria, Plasmodium falciparum.

DYSBINDIN AND AMYLOID PRECURSOR PROTEIN INVOLVEMENT IN NEURAL DEVELOPMENT AND BEHAVIOR IN *DROSOPHILA MELANOGASTER*.

Wacey Gallegos* & Ann Buchmann, Department of Mathematics and Natural Sciences, Chadron State College, Chadron, NE 69337

Amyloid Precursor Protein (APP) and dysbindin are both involved in brain development and neural outgrowth. APP is a membrane-bound protein which is found in various tissues including the brain and spinal cord. APP undergoes a cleavage to produce functional peptides of amyloid-alpha or amyloid-beta. Amyloid-alpha has been discovered to be involved in neural outgrowth, while amyloid-beta is generally involved in plasticity of neurons. A high accumulation of amyloid-beta peptide is a major characteristic of Alzheimer's disease as well as other neurodegenerative disorders. In APP knock-out mice, locomotion, learning, and long-term memory are negatively affected. The dysbindin protein is produced from the Dystrobrevin-binding protein-1 gene (DTNBP-1) and is involved in neural outgrowth. Polymorphisms in DTNBP-1 seem to confer susceptibility to schizophrenia. The expression rate of DTNBP-1 can be affected by interacting protein factors, and dysbindin may form protein aggregates when highly expressed in neurons similarly to amyloid-beta aggregates. There is limited understanding of the potential interactions between APP peptides and dysbindin protein during brain development. This project used Drosophila melanogaster knock-outs of DTNBP-1 and APP as well as a double APP/DTBP-1 knock-out to determine the effects of APP and dysbindin on neural development and behavior. To determine the effects of the mutations to brain development, D. melanogaster cortical tissue was examined using microtome techniques and staining procedures. The effects to learning and memory was examined using climbing assays and conditioning to stimulant of adult D. melanogaster. Neural assays were conducted on developing instar larva to determine the effect of APP and dysbindin on neural outgrowth.

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

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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 natural spermine analogs have shown Kd¬ values up to ~5 mM, and at least one synthetic analog with a Kd value of ~20 μM. Future experiments will focus on X-ray crystallography of this RNA.

Our results suggest that translational frame-shifting in OAZ expression evolved for spermine-dependent regulation of the OAZ protein. Thus, the OAZ1-PK RNA may function as a spermine sensor

and mammalian riboswitch, indicating a wider expression of riboswitches amongst eukaryotes and offering a novel mechanism for affecting metabolic processes in cancer and other diseases. 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.

DEFINING THE BIOLOGICAL ROLE OF THE CONNEXIN43 CARBOXYL TERMINAL ALPHA HELICAL DOMAINS

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Gap junctions play a vital role in cell to cell intercellular communication. These channels are formed by the apposition of connexons from adjacent cells and allow for the cytoplasmic exchange of small metabolites and electrical impulses. Each connexon is further made of six individual tetra-span proteins called connexins with connexin43 (Cx43) being the most commonly studied isoform. Post-translational modifications of its carboxyl-terminal (CT) tail (especially by phosphorylation) regulate the gating and degradation of the gap junction channels. Casein kinase I (CK1) phosphorylates residues at sites in between two alpha helical domains (A315-M320 and D340-A348) on the CT tail opening gap junction channels. The two alpha helical domains have been found to dimerize between connexins in a pH-dependent manner. CK1 phosphorylation is necessary for opening gap junction channels and we hypothesize that this phosphorylation inhibits the interaction of these alpha helical domains. Thus, we believe the dimerization of the two alpha helices causes the closure of the channel but CK1 phosphorylation prevents their interaction. Here, we characterized the interplay between CK1 and the alpha helical domains and their effects on gap junction communication. Mutants with deletions in alpha helix 1 (A315 - M320), alpha helix 2 (D340 - A348), or both were made and expressed in human HeLa cells. Results suggest that phosphorylation patterns were affected by alpha helix deletion, particularly concerning the hyper-phosphorylated bands in the ΔHelix 1 and 2 mutant. Localization of the gap junctions to the membrane was unaffected. EGF inhibited communication but when compared to the wild type, was inhibited less. This was especially true concerning the ΔHelix 1 mutant.

CHICKEN HATCHLINGS AS AN ALTERNATIVE HOST FOR BUGGY CREEK VIRUS.

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An understudied alphavirus is the Buggy Creek virus (BCRV), and unlike other alphaviruses BCRV is uniquely vectored by the swallow bug (Oeciacus vicarius). Swallow bugs further transmit BCRV to its avian hosts, the cliff swallows (Petrochelidon pyrrhonota) and house sparrows (Passer domesticus), when occupying the birds' nest. A limitation to studying this system is that the house sparrow nestling hosts can only be obtained during late spring in the wild as there are no commercial sources. We aimed to investigate other possible BCRV hosts, which would allow us to perform future large-scale animal studies for studying BCRV. We infected chicken hatchings with BCRV and found that peak viremia levels at 1-day post infection was sufficient for viral transmission to their vectors. Additionally, BCRV-infected chicks displayed reduced skeletal and body mass growth. These results indicate that chicken hatchlings can be used as an alternative and reliable host for BCRV, allowing us to pursue many more BCRV studies *in vivo*. Future directions include further investigation of the host's impaired growth due to BCRV as well as testing whether the common bed bug (Cimex lectularius), a close cimicid relative of the swallow bug, can serve as a BCRV vector. Using both chicken hatchlings and bed bugs as an alternative BCRV hosts and vectors enables us to study the interplay between viruses

and their host and vector-specific requirements, which may contribute to the success of viral transmission. Not only does this have human health relevance, but may also give insight into the evolution of viruses.

SECONDARY STRUCTURE ANALYSIS WITH SHAPE-MAP OF HUMAN HERPESVIRUS 8 POLYADENYLATED RNA.

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Kaposi's sarcoma-associated herpesvirus (KSHV also called Human Herpesvirus 8 or HHV8) is a herpesvirus linked to Kaposi's sarcoma and two forms of lymph node cancer. HHV8 infects cells and replicates its viral genetic material, creating an RNA transcript with no known protein coding function. The lncRNA encoded by HHV8 is known as polyadenylated nuclear RNA (PAN RNA). PAN RNA has been shown to promote important functions of HHV8, such as gene expression, replication, and immune modulation, despite PAN RNA's lack of direct protein translation. PAN has been shown to associate with multiple transcription related complexes that promote lytic replication including k-Rta, the driving transcription factor of the HHV8 lytic cycle. Analysis of the structure of the PAN RNA molecule gives perspective on how the molecule performs its role in the lytic cycle. The SHAPE-MaP method chemically modifies the molecule, converts it into cDNA wherein modified nucleotides generate mutations. By sequencing the molecule, the shape of the molecule can be inferred through algorithmic analysis. Using the exceptionally accurate SHAPE-MaP method to analyze PAN structure will refine the current understanding of the secondary structure of the molecule.

A SEMI-AUTOMATED SYSTEM FOR QUANTIFYING FOOT TEMPERATURE CHANGES FOLLOWING LOCOMOTION.

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During walking, the foot loses energy (negative net-work), which is likely dissipated into the plantar surface as heat. In healthy individuals, blood flow readily distributes this heat throughout the body and dissipates it to the environment. However, individuals who have altered blood flow to their extremities, (i.e. astronauts upon return to earth, and individuals with peripheral artery disease) may have a reduced ability to remove this heat, leading to deleterious temperature increases. Thermal imaging cameras are an important instrument for quantifying foot temperature change which allow for rapid collection of temperature distributions across the plantar surface. Despite their routine use in studying foot thermoregulation, no standardized methodology has been developed for evaluating regional changes in foot temperature on thermography images. The purpose of this study is to develop a semi-automated methodology for acquisition and analysis of foot thermography images. In short, this methodology involves a standardized procedure for normalizing foot temperature, acquiring thermography images, and a software tool for performing regional analysis of the resulting thermography image. The software tool is a user-supervised algorithm developed in MATLAB (Mathworks, Natick, MA) designed to identify temperature distributions within biomechanically important regions of the plantar surface. Pre-processing estimates approximate foot contour, which is refined with a minimum-cost graph-cut. Relevant foot regions (i.e. hallux, metatarsophalangeal (MTP), midfoot, arch and heel) are identified using an atlas-based approach. Temperature distributions are within each of these regions are stored for subsequent analysis. The intra- and inter-rater reliability of this method are evaluated in an ongoing study of healthy adult subjects, with temperature measurements made before, during and following 30 minutes of indoor track walking. Future work will utilize this methodology to analyze foot temperature changes due to locomotion in individuals who are at risk damage to their feet.

THE ORAL MICROBIOME IN FELINE STOMATITIS.

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Feline stomatitis is an oral inflammatory disease with an unknown etiology and limited available treatments. Because the oral cavity is home to many microorganisms, it is possible that changes in the oral microbiota trigger the initiation of feline stomatitis. In order to evaluate the role of oral bacteria in development of feline stomatitis, we performed metagenomic analysis on oral swabs from affected or control cats using next generation sequencing. Our results show the association of microbial changes with development of feline stomatitis. Altogether, these results could contribute to more successful therapeutic options.

MAPPING THE BINDING SITES FOR CAF-1 ON PCNA.

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Cellular replication and genome stability require the accurate replication of DNA and subsequent packaging into nucleosomes, which are composed of DNA wrapped around histone proteins. Nucleosome formation immediately following replication is controlled in large part by two proteins: proliferating cell nuclear antigen (PCNA) and chromatin assembly factor 1 (CAF-1). PCNA is a homotrimer that functions as a sliding clamp during replication and binds to and recruits CAF-1 to the replication fork. CAF-1 is responsible for forming nucleosomes by recruiting histones to the newly synthesized 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. PCNA interacts with over 50 different proteins during DNA-templated processes and almost all of these proteins bind to the same site on PCNA. However, our preliminary data suggests that CAF-1 may interact with PCNA at a secondary site, in addition to this canonical binding site. To study this secondary site of interaction, I have performed site-directed mutagenesis of several residues that we hypothesize are critically important to the novel CAF-1 binding site on PCNA and have begun binding and structural studies of the isolated proteins. Preliminary binding assays suggest differential binding between the mutant PCNA proteins and CAF-1, with different mutants demonstrating increased and decreased affinity. Of particular interest, one mutant PCNA protein shows increased affinity for CAF-1 in comparison to wild type PCNA. I am optimizing a fluorescence anisotropy assay to quantitatively investigate the kinetics of interaction between these mutant PCNA proteins and CAF-1 in comparison to wild type PCNA. The results of these studies will provide important information about the interaction between PCNA and CAF-1 and how cells maintain overall genomic stability. 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.

DEVELOPMENT AND CHARACTERIZATION OF A POLYMERASE CHAIN REACTION ASSAY FOR THE 16S RIBOSOMAL GENE OF *BORRELIA BURGDORFERI.*

Morgan Shipley*, Emmalynn Walvoord, Bailey Hallgren Meehan, and D. Michael Olive, Nebraska Wesleyan University, Lincoln, NE 68504

Lyme disease is the most common tick-borne human infection in the United States. It is a potentially debilitating, multi-systemic illness most frequently caused by the bacteria, Borrelia burgdorferi. Treatment based on accurate early diagnosis can be effective in keeping the infection from going into a chronic phase. However, due to the mistaken belief that the disease is not found in Nebraska, victims in this state are often misdiagnosed. In order to survey ticks found in Nebraska for the presence of Borrelia burgdorferi, we developed a polymerase chain reaction assay targeting the bacterial

16S ribosomal RNA gene. The assay sensitivity as determined on purified B. burgdorferi DNA was 100 genome equivalents. Because the reported bacterial load for ticks carrying Borrelia species is between 2 x 102 and 4 x 105 organisms, the assay sensitivity was judged to be sufficient. To rule out any interfering effects on the final assay, ticks not known to be hosts for B. burdorferi were cut into four pieces and added to serially diluted B. burgdorferi DNA followed by PCR amplification. The foreign materials had no effect on assay sensitivity. Assay specificity was verified by applying the assay to non-Borrelia bacteria. When the study is complete, the data will be compiled and a statewide risk map, indicating areas where infection with Borrelia burgdorferi is most likely to occur.

THE EFFECT OF COMMERCIAL FEED VS CUSTOM FEED ON TILAPIA AND LETTUCE GROWTH IN AQUAPONIC SYSTEMS.

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Two experiments were completed using tilapia and lettuce in aquaponics systems. Commercial fish food is one of the main costs of running aquaponic systems. People may need to or want to use their own fish food. One possible food recipe uses commonly available grains and the leaves from the moringa tree. This food has the advantage of being low-cost and widely available in countries such as Haiti. For both experiments one system was fed commercial fish food, the other system was fed a homemade food consisting of several grains, sunflower seed meal, and moringa leaves. The food particle size was changed between the two experiments. The first experiment showed significantly different rates of both fish growth and plant growth between the food types indicating greater growth with the commercial food. Water chemistry showed there appeared to be much more nitrate present in the commercial food system. The second experiment showed no significant differences between fish growth or plant biomass while the nitrate levels were again higher in the commercial food treatment. The results indicate promise for a low-cost highly-available food for aquaponic systems where commercial foods are either unavailable or uneconomical.

COMPARISON OF COMMERCIAL AQUAPONIC SYSTEMS: PATENTED VS RECLAIMED.

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Aquaponics are integrated systems that use fish effluent to supply nutrients for crop production. These are sustainably viable agricultural systems, yet system design remains relatively unknown. Public interest in aquaponic industry is growing both in rural and urban areas. To become more commonly used aquaponic systems need system designs that optimize productivity. To investigate system designs, this study was conducted to compare the productivity of a patented commercial aquaponic system to a reclaimed material aquaponic system built from commonly discarded containers. The patented system uses purpose-built components, while a reclaimed material system uses widely available parts. Between financial investment and system maintenance, it can be unclear which design is most economically viable for commercial use. This study assessed basil (Ocimum basilicum) and tilapia (Oreochromis mossambicus) productivity under different planting densities, and different flow regimes. We found no difference between the two systems in basil growth or tilapia growth. Higher basil density appeared to grow well in both systems. The different flow regimes did have a significance difference between them with a bell siphon flow system having greater plant growth. The maintenance on the systems are different however, with the patented system requiring less time to clean and maintain.

BIOLOGICAL AND MEDICAL SCIENCES

SESSION D

ISOLATION OF THE MAJOR OUTER MEMBRANE PROTEIN FROM *CHLAMYDIA TRACHOMATIS* FOR FUTURE VACCINE DEVELOPMENT.

Gustavo Zardeneta[2]*, Douglas Christensen[1], Kristy Hansen[1], [1]Department of Biology, [2]Department of Chemistry, Wayne State College, Wayne, NE 68787

Chlamydia trachomatis is one of the most commonly transmitted sexual infections among people of all ages and often is asymptomatic. According to the Center for Disease Control, there are approximately 2.86 million new cases occurring annually. An asymptomatic pregnant woman who does not receive treatment for the infection can pass it on to her child. The infected child usually has eye problems such as trachoma, which is the leading cause of preventable blindness in the world. In studies with mice, the major outer membrane protein (MOMP) of *C. trachomatis* has been able to effectively immunize the mice, preventing blindness. Previous attempts to isolate MOMP have been ineffective and appear to be due to complications with disulfide bonds within the protein. Previous work in our lab has generated a number of mutagenic variants aimed at elimination of disulfide bonding within the MOMP protein. This recent work focuses on the progress of over-expression and purification of these recombinant MOMP protein variants. This undergraduate research 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.

E**XAMINING THE POTENETIAL OF *LISTERIA MONOCYTOGENES* INLB AS A TOOL FOR DRUG UPTAKE.**

Josephine Peitz*, Shawn Pearcy, and Douglas Christensen, Department of Biology, Wayne State College, NE 68787

The protein InlB plays an important role in the invasion of host cells by the bacteria *Listeria monocytogenes*. InlB is a membrane-bound protein of *Listeria* that allows the bacteria to attach to host cells. After the protein has attached to a host cell receptor, the host cell's actin cytoskeleton pushes against the membrane and phagocytizes the bacteria, even if it is not a phagocytic cell. Because InlB is able to cause non-professional phagocytic cells to engulf the bacteria, we wanted to identify if it would be a good drug delivery protein. To start this process, a pET-46 construct was produced to house the InlB gene. This construct was transformed into *E. coli* BL21 cells for protein over-expression. Protein isolation, currently underway, is expected to be aided by incorporation of the foreign InlB into *E. coli* inclusion bodies. Partially purified inclusion body contents will be tagged with florescent for monitoring host cell invasion capability. 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.

SUBTOXIC EFFECTS AND MECHANISMS OF METAL NANOPARTICLES ON HUMAN CELLS.

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Silver, Titanium Oxide and Cerium Oxide nanoparticles (AgNP's, TiNP's, CeNP's) are commonly used as components in many cosmetic and medicinal products for their antimicrobial, UV shielding and antioxidant properties. While the benefits of such nanoparticles are widely touted by those in the cosmetic and medicinal products industry, the toxicological effects on human cells have not been completely studied. The objective of this study is to determine the severity of subtoxic "silent" effects that nanoparticles have on mammalian cells and more importantly their mechanism inside of the cell. This will be accomplished by comparative evaluation of the alterations in human cell metabolism and proteostasis induced by three of the most commonly used NPs (AgNP's, TiNP's and CENP's). It is expected based on the available literature that the nanoparticles will induce significant negative changes in the cells by disrupting the autophagy-lysosomal system as well increasing the activation of inflammasomes. Finally, we predict that AgNP's will behave differently than TiNP's and CeNP's inside of human cells after uptake, due to previous analysis that shows AgNP's produce far less cellular granularity in human cells after exposure in comparison to TiNP's and CeNP's.

DESIGN AND EVALUATION OF CNS TARGETED ANTIRETROVIRAL NANOPARTICLES.

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HIV continues to be one of the most prevalent yet treatable chronic viral infections in the world. While advancements in treatment have overwhelmingly increased rates of survival in HIV+ individuals, secondary pathologies such as HIV-associated neurocognitive disorder (HAND) occur in chronically infected individuals potentially due to HIV reservoirs in the CNS. Other literature also suggests that, when taken orally over decades, antiretroviral drugs such as dolutegravir produce peripheral neuropathies and neurodegeneration. We and our collaborators are currently in the preliminary stages of developing and testing cART drug delivery using nanoparticles with the potential to be trafficked across the blood-brain barrier (BBB). Polymeric nanoparticle (NP) antiretroviral drug encapsulations have shown promise in decreasing drug cytotoxicity, extending drug release, and increasing drug efficacy as compared to oral administrations. Such NPs targeted across the BBB for drug delivery may improve neurological issues associated with cART drugs. Our work focuses on the design of poly-lactic-co-glycolic acid (PLGA) NP encapsulations of dolutegravir (DTG) conjugated to holo-transferrin (hTf), a receptor ligand known to enhance transcellular transport through endothelial cells at the BBB. *In vitro* cell viability assays showed statistically significant differences in cytotoxicity of hTf-PLGA-DTG-NP versus DTG solution applications at nearly all experimental concentrations in HCMEC/D3 microvascular endothelial cells at 24, 48, and 96hr exposures when normalized to untreated controls. DTG treatments were applied to range from 10µg/mL to .001µg/mL. Cytotoxicity of NPs to primary rat astrocytes and cortical neurons are ongoing. Translocation of hTf-PLGA-NPs encapsulating Alexafluor 594 were visualized using confocal imaging at timepoints up to 7 days. NP translocation into cortical neurons was visible at 48hrs. NP translocation to primary astrocytes and HCMEC/D3 microvascular endothelial cell line cultures expressing zonular occludins are currently being performed and analyzed. Additionally, Alexafluor 594 loaded-NP and transferrin receptor co-localization experiments will be conducted. These results collectively indicate that our hTf-PLGA-DTG-NP are transported across the cell membrane and have decreased cytotoxicity in endothelial cell lines and primary cortical neurons and astrocytes. These preliminary data suggest that targeted NP

cART delivery to the brain may improve drug delivery and reduce cART neurological side-effects that often accompany chronic cART treatment.

EFFECTS OF HUMAN HOLO-TRANSFERRIN CONJUGATED NANOPARTICLES ON PRIMARY CORTICAL ASTROCYTES, BV2 MICROGLIA, AND PRIMARY RAT NEURONS *IN VITRO.*

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Recent MRI analyses of astronaut's brains following exposure to microgravity reveals narrowing of ventricular space, edema of the optic-disk, and activity associated with migraine headaches. Such physiological responses are associated with inflammatory responses of astrocytes and microglia to neuronal stress and/or damage in the CNS. Reducing or eliminating the inflammatory responses of astrocytes and microglia may help reduce the neurological side-effects of microgravity. Brain targeted nanoparticles that carry anti-inflammatory regulators to astrocytes and microglia may provide a safe, highly efficacious means to regulate inflammation in the brain. Overall our project is designed to determine whether human transferrin receptor (hTf)-targeted brain nanoparticles (NP) are able to translocate through the vascular endothelium and deliver anti-inflammatory mediators to astrocytes and microglia and reduce inflammatory cellular responses. We are in the preliminary stages of developing hTf-NPs and testing hTf-NP translocation to primary astrocytes, cortical neurons and microglial cells. Confocal analysis of primary cortical neurons exposed to hTf-PLGA encapsulations of Alexafluor 594 show nanoparticle uptake and no significant change in neurite outgrowth. Astrocyte and microglia nanoparticle uptake experiments are ongoing. Preliminary data suggests astrocyte uptake is occurring but in lower concentrations than neuron uptake. Cytotoxicity assays for hTf-PLGA-NPs are in development for microglia, neurons, and astrocytes. This research is funded by Creighton University George F Haddix President's Faculty Research Fund and NASA.

QUANTUM DOTS FOR SIMULTANEOUS ASSESSMENT OF ROS AND RADIOSENSITIZATION OF BRAIN CANCER CELLS.

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Glioblastoma is the most common primary brain tumor in adults and yet it remains one of the least treatable. Current standard of care which involves combinations of surgery, radiotherapy and chemotherapy, results in a median survival of only 15 months. This dismal outcome is partly due to the high radio-resistance of Glioblastoma. Here, we seek to enhance radiotherapy outcomes through radiosensitization. Having recently published our novel assay wherein we used fluorescence intensity modulation of CdSe/ZnS quantum dots (QDs) to assess reactive oxygen species (ROS) generation during chemotherapy and radiotherapy for cancer cells, we are applying this assay for concurrent measurement of ROS and radiosensitization. Using a Faxitron Cell Irradiator, we irradiate brain cancer cells (T98G Glioblastoma cells) treated with QDs and measure both their migration and the QD fluorescence intensity. We measure and quantify the migration using a commercially available Electric Cell Impedance Sensor (ECIS) Irradiated T98G cells attach and migrate significantly ($p<0.0001$) more than non-irradiated cells in the first 20 hours post irradiation. Preliminary results also show that the radiotherapy leads to QD intensity reduction due to ROS production as expected. Results for radiosensitization will be presented.

IMPROVING TREATMENT OF NEUROBLASTOMA WITH MIRNA.

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RNAi has been shown to affect mRNA and protein levels in cells. miRNA has been known to decrease protein expression in cells. Elevated MYCN levels have been implicated in severe cases of neuroblastoma with poor prognosis. Mir-34A has been shown to knock down MYCN protein expression, but miRNA alone has poor performance as a drug. Formulation of cholesterol modified polyplexes containing Mir-34A raises the plasma half-life as well as increases cellular uptake. The goal of this study was to test effectivity of Mir-34A on knocking down MYCN protein levels in BE(2)-C cells. Mir-34A was introduced to the cells via electroporation, and activity was assessed via ddPCR to quantify MYCN mRNA expression, as well as by ELISA to quantify protein levels. As expected, no effects were seen on MYCN mRNA levels since that is not the primary activity of miRNA. MYCN Protein levels were significantly lowered by Mir-34A, indicating that it is active in BE(2)-C cells.

INVESTIGATION OF CARNITINE PALMITOYLTRANSFERASE II DEFICIENCY IN NEURODEVELOPMENT.

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Carnitine palmitoyltransferase 2 (CPT2) protein is heavily involved in the process of beta oxidation of long chain fatty acids, which is necessary to generate ATP in the mitochondria. Research suggests that astrocytes, glial cells of the brain, rely on beta oxidation to support neural growth during development and for synaptic function in adulthood. Mutation of the CPT2 gene leading to a deficiency in CPT2 protein expression is associated with a plethora of severe medical symptoms such as respiratory and liver failure, seizures, hypoglycemia, and some cases schizophrenia. Given that there are multiple medical cases involving CPT2 deficiency and severe neurological symptoms, there is a clear need to investigate the relationship between CPT2, neurodevelopment, and synaptic function. Our central hypothesis is that transesterification of palmitoylcarnitine to palmitoyl-CoA by CPT2 is necessary for proper neural developmental and synaptic function and that disruption of CPT2 function leads to abnormal differentiation and migration of neuronal and glial progenitors, synapse formation and synaptic function. In collaboration with clinicians we are studying the genotypic and phenotypic profile of a male proband with confirmed CPT2 deficiency as compared to his heterozygous parents and unaffected fraternal twin. In our research, we are also developing a zebrafish model system to investigate the mechanisms by which CPT2 mutation affects overall brain development and synaptic communication. For these studies, CPT2 will first be verifiably knocked down in zebrafish. To date, injection of translation blocking morpholino constructs for CPT2 at the single cell stage results in ~78% viability. GFP is used to confirm delivery of the morpholino. Western blot analysis will determine knock down of CPT2 protein expression. Future experiments will compare a translation blocking morpholino, a slice blocking morpholino and a CRISR/Cas9 knockout of CPT2 expression in zebrafish. Mutant zebrafish will be assessed for differences in neuronal differentiation, synapse formation, and behavior as compared to controls. Taken together our studies should provide insight into the role of CPT2 during normal brain development and synaptic function in adulthood.

USING METABOLIC IMAGING TO QUANTIFY UVA-INDUCED DAMAGE IN SKH-1 MOUSE SKIN.

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Cancer development is characterized by altered growth-factor signaling pathways, which adjust the metabolic phenotype to favor tumorigenesis and disease progression. Metabolic changes *in vivo* are evident by changes in concentration and cofactor binding of NAD(P)H and flavins. To quantify metabolic perturbations induced by chronic UVA exposure *in vivo*, we created a non-invasive multiphoton laser scanning image platform for in situ metabolic imaging of NAD(P)H within the skin of anesthetized mice. Age-matched SKH-1 hairless mice were divided equally into sham and UV treatment groups, with the treatment group receiving a daily dose of 15kJ/m2 UVA. NAD(P)H phasor fluorescence lifetime imaging microscopy (FLIM) was used to characterize metabolism of keratinocytes as a function of depth within the epidermis of both groups over a period of 25 weeks. Early changes in the enzyme-bound-to-free ratio of NAD(P)H were clearly evident prior to the onset of disease, with UVA- treated mice showing a significantly greater proportion of enzyme-bound NAD(P)H. As tumors developed, UVA- treated skin had a higher bound to free NAD(P)H ratio than untreated skin. This study demonstrates the feasibility and challenges of phasor FLIM metabolic imaging for long term longitudinal studies. 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.

CORRELATING HISTOLOGY TO METABOLIC IMAGING DATA OF SKH-1 MOUSE SKIN.

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Characterizing skin cancer development non-invasively has proven difficult, and the industry standard for diagnosis is biopsies. Tumorigenesis and cancer progression can be modeled by differing concentrations and binding characteristics of endogenous coenzymes like nicotinamide adenine dinucleotide (NADH) and flavoproteins. NADH phasor FLIM analysis has provided a promising new diagnostic technique for tracking hallmarks of cell metabolism alterations typical of cancer progression non-invasively. We tracked tumorigenesis in skin of anesthetized SKH1 hairless mice exposed to chronic UVA using in situ metabolic imaging of NADH. Age-matched mice were divided equally into sham and UV treatment groups, with the treatment group receiving a daily dose of 15kJ/m2 UVA. NADH phasor FLIM was used to characterize the metabolism of keratinocytes and metabolism of suspected tumors over a period of 24 weeks. The lifetime difference of tumors and normal damaged skin was statistically significant from control skin, with controls having a lower average lifetime. We then used histology on suspected tumors to demonstrate that changes in metabolism were also marked by a change in phenotype. This study demonstrates the feasibility and applicability of phasor FLIM metabolic imaging for the early detection of UV damage and skin cancer. 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.

CHITOSAN ACTS AS AN IMMUNE ACTIVATOR THROUGH STIMULATION OF INNATE IMMUNE SIGNALING PATHWAYS AND CYTOKINE EXPRESSION *IN VITRO*.

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Annually the influenza A virus (IAV) causes significant health concerns throughout the world, despite the production of seasonal IAV vaccines, highlighting the inadequacy of current vaccine coverage. Particularly, seasonal vaccines against the IAV have had an estimated effectiveness of 10-60%. In an effort to improve IAV vaccine efficacy, our research has been focused on inducing a balanced immune response through stimulation of antigen presenting cells' (APC) with synthetic adjuvants. Synthetic adjuvants are agents that modify immune responses to vaccine antigen by mimicking natural irritants or prolonging presentation of the antigen. However, few adjuvants are well studied and even fewer are currently licensed for use in vaccines. Currently, we are investigating chitosan, a deacetylated polymer derived from chitin, for its ability to act as an adjuvant by inducing cytokine expression in bone marrow derived dendritic cells (BMDCs) and activating two innate transcription factor pathways denoted as Interferon Regulatory Factor (IRF) and NF-kB in J774 Dual Reporter Cell lines. Results using J774 Reporter Cells have indicated that different molecular weight derivatives of chitosan have distinct adjuvant properties by activating the IRF pathway and low stimulation of the NF-kB pathway. Preliminary results have also indicated chitosan enhances cytokine and chemokine expression, specifically the inflammatory cytokine IL-6. Together, this suggests chitosan acts as an immune stimulant by activating an innate immune response in APC. Further, these discoveries have provided preliminary directions to investigate differing concentrations of chitosan molecular weight derivatives on immune stimulation and cytokine expression. Additionally, our data suggests there may be a possibility to combine chitosan with other immune adjuvants and induce a balanced immune response and potentially increase the efficacy of vaccine against influenza.

ANNUAL BUGGY CREEK VIRUS PHENOTYPE DYNAMICS IN SWALLOW BUGS *(OECIACUS VICARIUS).*

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Alphaviruses are arthropod-borne viruses known to cause millions of cases human disease each year. Among alphaviruses, Buggy Creek virus (BCRV) is unique as it is transmitted by a cimicid insect (the swallow bug) closely related to the human bed bug (Cimex lectularius & Cimex hemipterus). While human bed bugs are not known to transmit human disease, they are considered potentially competent vectors, making studies of alphavirus-cimicid vector systems pertinent to prevent possible future epidemics. Swallow bugs, which feed on cliff swallows (Petrochelidon pyrrhonota), exist within cliff swallow nests year-round while cliff swallows are only present during late spring and early summer to breed and rear nestlings. Previous research has indicated that Buggy Creek virus undergoes seasonal changes in virulence in swallow bugs, with virally-induced cytopathic effect being highest in the summer, but low the rest of the year. However, specific details of these seasonal changes have not been elucidated. We compared the cytopathic effect of swallow bug homogenates collected monthly with apoptotic activity in Vero cells, and determined that while cytopathic effect may be undetectable throughout much of the year, apoptotic activity is a more sensitive measurement for alphavirus phenotype determination in these insect vectors. Levels of virally-induced apoptosis were detectable and differentiable among bug ages and months, especially May through July. These results allow us to more accurately determine viral phenotype in swallow bugs throughout the year. Further, these results

have the potential to improve our ability to predict the timing and seasonality risk of arboviruses in other disease systems. 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.

THE EFFECTIVENESS OF INFRARED CAMERA ON A CONSUMER DRONE (UAS) FOR WILDLIFE IMAGING.

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Drones (UAS) are becoming more widely used by hunters, wildlife managers, conservation officers, and biologists. One of the newer capabilities of consumer-level drones on the market today is infra-red imaging. We have obtained a consumer-level infra-red camera and have been using it on a DJI Inspire I drone to obtain images of animals under a variety of environmental conditions and flight profiles. There are several results of this work we found interesting. These include a) current drones are reliable and stable in flight b) current consumer-level infra-red cameras are expensive and have limited imaging capabilities c) ground temperatures and backscatter vary greatly in Nebraska and d) these factors can make visualizing animals difficult in the infra-red. We found technical challenges remain for the use of IR cameras. Once we became familiar with the equipment our imaging became better. Pairing IR imaging with true-color video recording was particularly useful. At present consumer-level infra-red cameras are limited in capability but may be useful for specific research circumstances. Circumstances that produce the best results include relatively large animals, cool ground surface temperatures, and animals that tolerate the presence of drones. Drones are useful for accessing locations that are difficult to get to and can inspect a large area from a single launch location.

POLLEN TUBE DEVELOPMENT IN WATER-POLLINATED STUCKENIA PECTINATA.

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Hydrophily is a rare mechanism of pollination found in angiosperms in which pollen is transported to the stigmas via the water surface or through underwater currents. Water pollination is known to be correlated with certain pollen traits, but little is known about the consequences of the transition to hydrophily for post pollination development. 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 dye and then observed under a light microscope and imaged. The germination status of each pollen grain was documented, and the length of the longest pollen tube was measured. The timing of stigma receptivity, pollen reception and germination, as well as ovule entry was documented. A final pollen tube growth rate was calculated for the species using the length of the longest pollen tube and time to germination. Results from this study will be compared to similar studies done with related hydrophilous species to better characterize this life history stage in water pollinated plants.

DETERMINING THE PREVALENCE OF VECTORED PATHOGENS IN ELKHORN RIVER VALLEY *DERMACENTOR VARIABILIS* IN NEBRASKA.

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The American Dog Tick (Dermacentor variabilis) is the most prevalent hard bodied tick in

Nebraska. D. variabilis is known to vector infectious bacteria. The different pathogenic bacteria that may be present in D. variabilis from the Elkhorn River Valley has yet to be determined and compared to prevalence rates in other part of Nebraska. In this study, D. variabilis from multiple sites near the Elkhorn River in northeast Nebraska were collected. Total DNA was extracted and multiplex PCR using species specific primers and gel electrophorese was used to identify DNA of spotted fever group Rickettsia, R. rickettsii, E. chaffeensis, E. ewingii, C. burnetii, A. phagocytophilum, and F. tularensis. E. ewingii was found in 23% of Elkhorn River Valley ticks, but all infectious bacteria were identified in ticks from the Elkhorn Valley. Further analysis with PCR using single primer sets and DNA sequencing will be completed confirm the identity of presumptive positive samples.

DEVELOPMENT OF A SYSTEM TO SELECTIVELY RECRUIT CHROMATIN ARCHITECTURAL PROTEINS USING INDUCIBLE HETERODIMERS.

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Chromatin is organized by architectural proteins into a spectrum of compaction from tightly packed regions of heterochromatin - in which genes are typically silenced - to loosed organized regions of euchromatin - in which genes are readily expressed. However, the precise chromatin configuration created by various architectural proteins remains unclear, as does the time required by the protein to reorganize the DNA. In an effort to study these properties, we have created an inducible heterodimerization system that allows for chromatin architectural proteins to be selectively recruited to stable genomic integration of 256 tandem repeats of the lac operator in CHO cells. Protein recruitment and chromatin reorganization can be monitored by fluorescence microscopy in live cells. We have created a series of custom plasmids encoding both parts of our inducible heterodimerization system, and have demonstrated that it is capable of recruiting a chromatin architectural protein to the lac operator array in live cells.

INSULATOR PROTEIN SCREEN IN *SACCHAROMYCES CEREVISIAE.*

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Insulator proteins serve as boundary elements in chromatin that serve to limit the spread of repressive histone modifications that lead to the formation of heterochromatin. Although a number of insulator proteins such as Reb1 and Gypsy have been identified in S. cerevisiae and D. melanogaster, CTCF is the only mammalian protein shown to have insulator activity. CTCF belongs to a category of proteins that cause large-scale reorganization of chromatin sequences, and has been implicated in the establishment and maintenance of euchromatin. Here, we test whether other human chromatin architectural proteins, including Satb1, Satb2, and MeCP2 exhibit insulator activity when expressed in yeast. Our insulator assay directs these candidate proteins to a binding site between a telomere and a sub-telomeric gene that would normally be silenced by the telomere position effect. Specific binding is achieved by fusing the candidate protein to the DNA binding domain of the yeast Gal4 transcription factor. This directs the candidate protein to four tandem copies of the UAS binding site. An insulator would activate this gene by sheltering it from the spread of repressive histone modifications, while a non-insulator would leave the gene silenced.

GROWTH RATE OF A BIOFILM *ARTHROBACTER AURESCENS* TC1 SYSTEM GROWN IN GLUCOSE + ATRAZINE MINIMAL MEDIA.

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Atrazine is a widely used herbicide that can contaminate groundwater used by people and

livestock in rural areas. Removal of atrazine contamination using biofilm-based technologies is one approach to remediation that is being investigated. Arthrobacter aurescens TC1 is a bacterial strain for which there is some evidence of a bioremediation effect on atrazine-contaminated water. In this investigation, the growth kinetics of the biofilm cell Arthrobacter aurescens was evaluated in a glucose minimal media. In order to assess the effects of the Arthrobacter aurescens on Atrazine, a baseline growth curve was found from varying conditions of glucose without Atrazine present. Growth kinetic experiments were performed at constant temperatures and shear stress in each reactor experiment at varying concentrations of glucose. Biofilm accumulation was monitored over time from which a growth rate could be measured. An estimate of yield was also performed. This growth kinetics data can be used to facilitate the design of a fluidized bed reactor system for bioremediation of atrazine from groundwater.

EFFECT OF ANDROGEN RECEPTOR ON SELF-GROOMING IN MICE.

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Many mammals, including rodents, use a variety of olfactory behaviors to attract or indicate interest in potential mates. One such behavior is self-grooming. Sex differences in self-grooming have previously been seen in meadow voles, Microtus pennsylvanicus. These differences are associated with differences in the condition, such as diet quality and gonadal hormone status, of both the groomer and the opposite-sex scent donor. Testosterone, the major male gonadal hormone, acts primarily by binding to the androgen receptor (AR). However, it is unclear if the presence or absence of AR in male and female rodents affects their olfactory behaviors, including self-grooming, towards opposite-sex conspecifics. Therefore, we hypothesized that the presence or absence of AR in both subject and scent donor mice affected the self-grooming of the former towards odors of the latter. We exposed male and female mice to soiled bedding from an unknown, unrelated mouse and recorded the amount of time the subject spent self-grooming over the next 5 minutes. We predicted that female mice with two copies of the wildtype AR gene (WT female), female mice with one wt copy and one dysfunctional copy of AR (carrier female), and male mice with a dysfunctional AR (tfm male) will spend more time self-grooming in response to the odor of male mice, whereas WT males will spend more time self-grooming in response to the odors of female mice. Furthermore, we predicted that male mice would spend more time self-grooming in response to bedding from WT females. Such results would suggest that AR plays a role in establishing male-typical patterns of self-grooming and also influences the attractiveness of an animal's scent.

CONSISTENCY OF BEHAVIORAL PLASTICITY ACROSS DIFFERENT SELECTIVE CONTEXTS.

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Animals often alter their behavior in response to predation risk. This study considers how perceived predation risk affects prey behavior in Xiphophorus helleri. Specifically, this study investigates the behavior of male green swordtails in high versus low risk predation environments. Xiphophorus are freshwater, live-bearing fishes that have been studied extensively since the early 1800s, resulting in a wealth of information about Xiphophorus biology. In addition, Xiphophorus has been developed as a major animal model to address human health issues, and, is one of the top five model animal systems for gene mapping. Studies with Xiphophorus have revealed a gene on the sex chromosomes that determines age at maturation, as well as adult size. Variation at this locus also influences male mating behavior. This study investigates how variation at this locus influences

consistency of antipredator behavior in both: a male mating context and a male-male competition context. Each test male is scored for intersexual behavior and intrasexual behavior. Trials are conducted in a 40”x12”12” 15-gallon tank with a 2”x2” grid at the bottom to quantify fish movement throughout the tank. All trial are videotaped or subsequent scoring. Three plant refuges are equidistant from one another at the surface. The top and front views are filmed to be subsequently scored. Prior to each trial, the test subject is exposed to either a predator present or predator absent environment. Each trial is 40 minutes in length. This study will determine whether changes in male behavior in response to a predator is consistent within individuals in a male-female and male-male context.

EVOLUTION OF A rRNA GROUP I INTRON IN THE LICHEN *TELOSCHISTES CHRYSOPHTHALMUS.*

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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 these introns arise from degeneration of group I introns. Here we focus on one lineage of introns found at a single position of nrRNA in Teloschistes chrysophthalmus. We have sequenced introns from 44 samples across the North American range of the species and will focus on 20 of these here. A phylogeny was inferred using ITS sequences and we found that the samples, with one exception, form a well-supported monophyletic group. Within this group, there are four subgroups that each have moderate to strong statistical support. The introns range in size from 206-407 nts. All introns at this site have donor, acceptor and branchpoint sequences typical of spliceosomal introns. It is clear that none of the introns are canonical group I introns, but a subset may possess remnant structures. Finally, we were also interested in characterizing the *in vivo* splicing ability of these introns. We found variability in splicing ability, with some appearing not to splice at all and others splicing, though perhaps inefficiently. Sequencing of these products suggest that there may be different subsets of introns within a genome that differ in splicing ability. In general, it appears that the intron at this site is exceptionally variable. This would be expected in cases where there is reduced selection pressure, which is what we predict to be the case for transitional introns.

EFFECT OF DIETARY PROTEIN CONTENT ON THE RESPONSE TO OVER-MARKS AND ANDROGEN RECEPTOR EXPRESSION IN MICE.

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In both humans and rodents, males outperform females in tasks measuring spatial memory, suggesting a role for gonadal steroids. One example of spatial memory in rodents is the ability to discriminate between the top- and bottom-scent donors of an over-mark. Previous research has indicated that meadow voles fed a low-protein diet or that have been food-deprived spent similar amounts of time investigating the scent donors of an over-mark. Interestingly, these treatments resulted in lower estradiol levels in female voles. However, it is unclear if this lack of preference due to diet is due to cognitive defects associated with the diet or decreased interest in opposite-sex conspecifics due to lower gonadal hormone levels. Therefore, this study tested the hypothesis that the protein content of the diet affects an individual’s spatial memory in a mouse model that lacks androgen receptors (AR). Mice were fed either a high- or low-protein diet for 30 days and then exposed to an over-mark to test spatial memory.

Brain activity in response to over-mark exposure was determined by measuring c-Fos expression in brain areas associated with both spatial memory and processing olfactory signals, such as the hippocampus and medial amygdala. We also measured AR expression in these areas to determine if it played a role in spatial memory of mice. We predicted mice fed a high protein content diet will show a top-scent preference and express higher levels of c-Fos and AR in the appropriate brain regions. This would suggest that protein content of the diet affects spatial memory and is facilitated by AR.

WHOLE-GENOME SEQUENCING AND DE NOVO ASSEMBLY OF ENVIRONMENTAL BACTERIA.

Sydney Robertson and John Kyndt, Bellevue University, Bellevue, NE.

Next generation sequencing (NGS) has drastically influenced modern biotechnology and many scientific applications. The power of NGS lies in the high-throughput sequencing and utilization of massive parallel processing, permitting a significantly small sample size to be amplified rapidly for in-depth analyses. Interspecies comparison of whole genomes and metabolic functions provides further insight into understanding microbiological properties and potential evolutionary connections.

Our general goal was to obtain and compare whole genome sequences trough NGS of various photosynthetic bacterial organisms. The various Rhodopseudomonas, Chlorobaculum, and Rhodobacter species had not been sequenced before and were previously isolated from many environments ranging from the coasts in California, to ground water on a sewage farm, to thermal hot springs of Yellowstone National Park. DNA was isolated using the GeneJET DNA purification kit (Thermo Scientific). The DNA library was then prepared with the Nextera Flex library prep kit (Illumina), allowing the genome to be sequenced using an Illumina MiniSeq system. De novo assembly and annotation of each species' genome allowed us to study its unique metabolism and compare the whole genome to other closely related species.

By evaluating species differentiation using average nucleotide identity, we found that there is a need for further clarification of taxonomic positioning of several of these species. A comparison of Rhodopseudomonas species suggested a separate taxonomic species designation for R. rutila, where interpretation of the genus Chlorobaculum suggests 24CR become its own species, as well. These draft whole genomes demonstrate the need for deeper insight into metabolic function and interspecies relationships.

CHEMISTRY AND PHYSICS

CHEMISTRY

RAPID SCREENING OF DRUG-PROTEIN INTERACTIONS IN DIABETES BY HIGH-PERFORMANCE AFFINITY CHROMATOGRAPHY.

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High performance affinity chromatography (HPAC) was used in a rapid zonal elution format to screen the binding strengths for several first and second-generation sulfonylurea drugs with human serum albumin (HSA) and several modified forms of this protein. The *in vitro* modifications of this protein that were examined included glycation, as occurs during diabetes, and the formation of advanced glycation end-products (AGEs) due to the reaction of HSA with glyoxal or methylglyoxal. These studies were carried out with the following sulfonylurea drugs that are used to treat type II diabetes: chlorpropamide, tolazamide, tolbutamide, acetohexamide, glicazide, and glipizide. The

drugs were each injected onto 10mm x 2.1mm i.d. affinity microcolumns that contained normal HSA or a modified form of HSA, with the retention of the drug being measured at 37°C and in the presence of pH 7.4, 0.067 M potassium phosphate buffer. The retention factors for these drugs were measured in replicate and required only 1-5 min per injection. The resulting information made it possible to examine the relative changes in binding strength for each drug as the type of HSA was varied. For instance, the retention of these drugs, when corrected for the overall protein content in the column, gave up to a two-fold increase or decrease in binding strength when going from normal to glycated HSA or one of the forms of AGE-modified HSA that were examined. These results indicated that affinity microcolumns and a zonal elution format could be an effective approach for studying the interactions of sulfonylurea drugs with normal HSA and modified forms of this protein. Such information may be useful in future applications in the field of personalized medicine.

PSEUDOMONAS AERUGINOSA GROWTH ON TITANIUM AND MODIFIED TITANIUM SUBSTRATES.

Jaysa Hoins* and Chris Huber, Department of Chemistry, Doane University, Crete.

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 importance of preventing growth of biofilm, we decided to focus on bacterial attachment. Specifically, we are trying to quantify Pseudomonas aeruginosa, strain PA01, biofilm growth on Ti and modified surfaces, that could further inhibit biofilm growth. When biofilm growth occurs on Ti orthopedic implants, it could cause infections in the patients receiving the surgery leading to greater problems. We will be considering how biofilm attachment can be further inhibited by comparing different modified layers deposited on top of Ti, while using a glass slide as a control. 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 can further inhibit the amount of biofilm growth on titanium. We have established that Ti already leads to less growth than on glass, and we will begin studying the biofilm growth on modified Ti surfaces in the near future.

ANALYSIS OF SOFT DRINK ADDITIVES ON CARBON DIOXIDE NUCLEATION REACTION RATE IN AQUEOUS SOLUTIONS.

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The Mentos™ and Diet Coke™ reaction is a commonly used science demonstration in schools throughout the United States. Dropping a Mentos™ candy into a bottle of Diet Coke™ causes a violent eruption of soda. Information regarding the affect of common additives on this reaction is largely unavailable. This research attempts to identify the role of common soft drink additives on the rapid nucleation rate seen in the Mentos™ and Coke™ reaction. Aqueous solutions containing common soda additives were carbonated at 30 PSI. Nucleation was induced via immersion in a sonic bath; carbon dioxide gas nucleation activity was measured using a pressure sensor. Initial reaction rate was analyzed during the first one second following nucleation induction. At levels like that of commercially available soft drinks aspartame, caffeine and potassium benzoate all have a significant activating effect on reaction rate compared to water ($p<0.05$), increasing reaction rate by 243%, 184%, and 546% respectively when compared to distilled water. When found in elevated levels (10x commercially available), caffeine and aspartame increased reaction rate by 294%, and 710%, respectively. Diet Coke™ was found to have a reaction rate 243% higher than carbonated distilled water. The reaction rate of potassium benzoate, at commercially available levels, was found to be significantly increased compared to Diet

Coke™ ($p=0.01$). All other additives were found to be the same as Diet Coke™ ($p>0.05$). The physical changes caused by these additives in aqueous solutions increases the nucleation rate in aqueous solutions. Each of the common additives plays a role in the rapid nucleation observed in the Mentos and Coke reaction.

BIO PRODUCTION OF ADIPIC ACID FROM LIGNIN-DERIVED AROMATICS USING ENGINEERED PSEUDOMONAS PUTIDA.

Howard Willett*, Joshua Mueller, Bin Ma, Xinyuan He, and Wei Niu, Department of Chemical and Biomolecular Engineering, University of Nebraska-Lincoln

Current production of adipic acid relies on petroleum-derived precursors. As of 2016, the adipic acid market was valued at 5.56 billion dollars, with most of chemical used for the synthesis of nylon-6,6. With the projected increase in global demand, a renewable resource that does not compete with current food or fuel infrastructure is highly desirable for the production of adipic acid in order to replace petroleum-derived precursors. Lignin is an attractive starting material as it accounts for 30-40% of plant biomass by carbon, but there are currently no large-scale uses for lignin due to its inherent heterogeneity and difficulty in processing. Pseudomonas putida KT2440 is a Generally Regarded As Safe (GRAS) microbe that is capable of degrading many aromatic compounds, including environmental pollutants and plant degradation material. We report the engineering of P. putida strain for de novo biosynthesis of adipic acid from lignin-derived aromatics. To this end, we devised a biosynthetic route to connect the endogenous aromatic degradation pathway in P. putida with an artificial biosynthetic pathway through directing a key metabolic intermediate, beta-ketoadipoyl CoA, into the microbial synthesis of adipic acid. Engineering efforts were directed into optimizing the carbon flux and cultivation conditions. To confirm the formation of biosynthetic intermediates/product, organic synthesis methods and 1H NMR analysis were applied.

CHALLENGES OF USING RATIONAL DESIGN TO OPTIMIZE SUBSTRATE SPECIFICITY FOR THE SURPRISINGLY PROMISCUOUS L-TYPE AMINO ACID TRANSPORTER (LAT1).

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The L-type amino acid transporter 1 (LAT1, SLC7A5) allows dietary amino acids to enter the brain, as well as transporting drugs that resemble natural amino acids (e.g. gabapentin and *L*-DOPA). As amino acid-drug conjugates (prodrugs) must compete with millimolar concentrations of endogenous amino acids for the transporter, it would be beneficial to obtain more potent amino acid promoieties. To better understand key specificity determinants that could improve potency, we developed models of the LAT1 binding site to guide the design and synthesis of substituted analogs of phenylalanine and histidine. Furthermore, we evaluated the structure-activity relationship (SAR) for both enantiomers of several naturally occurring LAT1 substrates. Analogs were tested in *cis*-inhibition and *trans*-stimulation cell assays to determine potency and uptake rate. Remarkably, LAT1 can transport amino acid-like substrates with wide-ranging polarities including those containing ionizable substituents (i.e. carboxylic acid and amine). Additionally, the rate of LAT1 transport was generally non-

stereoselective, even though our SAR data suggest that enantiomers likely exhibit different binding modes. Though our models have helped us to generate hypotheses for ligand design, they are currently unable to explain some of the divergent SAR that we have observed for this seemingly capricious transporter. We will present the synthesis and SAR of novel LAT1 substrates and inhibitors, as well as provide examples of how our models have fared in predicting ligand-transporter interactions. Our findings have greatly expanded what is known about LAT1 substrate specificity and has broad implications to the development of new treatments for brain disorders and cancer.

CURCUMIN, QUERCETIN AND THEIR COMBINATION FORMULATIONS: CHARACTERIZATION, RELEASE STUDIES, & ANTI-OXIDANT ACTIVITY.

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Curcumin and Quercetin are phytochemical compounds that have been found to possess powerful anti-oxidant properties. Anti-oxidant activities resulting from these compounds results in the elimination of free radicals present in the body, and therefore, prevent from oxidative damage associated with various pathological conditions. The main objective of our current research is to formulate and characterize these poorly soluble phytochemicals and their combinations for their synergistic capabilities. Release studies and anti-oxidant activities (using DPPH and FRAP assays) of the formulated phytochemicals and their combinations were determined. Formulations were prepared by combining curcumin and quercetin with a lipid (Compritol) along with a surfactant and a polymer (PVP) both separately, and in combination at ratios of 1:1, 1:2, 2:1, and 5:1 (drug[s]: lipid & polymer). Using XRD, we tested the configurations of our samples, and found the formulations to have no sharp peaks when combined with the lipid and polymer, verifying that our compounds are uniformly dispersed/ converted into amorphous form in the lipid-polymeric matrix. IR spectroscopy results revealed that the functional groups of the phytochemicals were masked by the surfactant but significant peak shifts indicated the presence of interactions between various components of the formulations. Presence of curcumin and quercetin in the formulations were confirmed by UV-Vis spectroscopy at their standard absorbance of 425 nm and 370 nm. Simultaneous solubility and anti-oxidant studies of the prepared formulation showed free radical DPPH concentrations reductions at increasing rates over a period of 24 hours. FRAP assay showed a 10-fold increase in absorbance over a 24-hour period for the formulations confirming anti-oxidant activities of the formulations. Prepared formulations were found to be stable for 3 months at room temperature.

WHEY PROTEIN AS A CARRIER FOR DELIVERY OF POORLY SOLUBLE ANTIOXIDANTS.

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Curcumin and Resveratrol are phytochemical compounds that have been found to possess powerful anti-oxidant properties. Due to their synergistic effects as antioxidant through the inhibition of certain response pathways, curcumin and resveratrol combinations have significant therapeutic potential. However, due to their poor oral bioavailability, which is primarily rooted in limited aqueous solubility; their synergistic potential for therapeutic purposes is unobtainable. This study seek to utilize whey protein in conjunction with a hydrophilic polymer as carrier for encapsulation and controlled delivery of curcumin, resveratrol and their combinations. Dried whey protein based delivery system of anti-oxidants and their combinations, hydrophilic polymer PVP were prepared at a 1% and a 5% loading using a lypholization method. Solid state characterization of formed delivery systems was carried out by X-ray powder diffraction (XRPD), infrared (IR) spectroscopy and differential

scanning calorimetry (DSC). Dissolution and DPPH assays were carried out in buffer and aqueous mediums using UV method to determine the compounds release over time and their anti-oxidant potential. Stability of drug delivery systems was evaluated over a time period of 3 months at room temperature. Solid state characterizations confirmed whey protein dispersions were amorphous in nature and anti-oxidants are uniformly dispersed throughout the system. Dissolution and aqueous solubility studies showed a continuous release of anti-oxidants over a time period of 24 hours and significant increase in solubility of both curcumin and resveratrol. XRD showed that the formed delivery systems remained amorphous for 3 month and DSC studies showed some insights on the role of miscibility and intermolecular interaction on the stability and solubility enhancement, however further characterization is required for confirmation.

CHARACTERIZATION OF CARBOXYLIC ACID REDUCTASES AS CATALYSTS FOR BIOSYNTHESIS OF INDUSTRIAL CHEMICALS.

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Carboxylic acid reductases (CARs) are of great interest in industrial biocatalysis for their ability to reduce a wide range of carboxylic acid substrates to their corresponding aldehydes, which serve as precursors in biofuel or bio-based chemical syntheses using microbial hosts. CARs are multi-domain enzymes with an N-terminal adenylation domain, a C-terminal reduction domain, and a linkage domain that contains a post-translationally attached phosphopantetheine moiety to transfer covalent intermediates from the N to the C domain. In this work, we identified and characterized CARs for their catalytic activities on short-chain hydroxy acids and dicarboxylic acids, which are common microbial cellular metabolites. All characterized enzymes exhibited broad substrate specificity. Higher catalytic efficiencies were observed on hydroxy acid substrates in comparison to dicarboxylic acid substrates of the same carbon-chain length. In addition, catalytic efficiencies on hydroxy acid and dicarboxylic acid substrates increased as carbon-chain length was increased from C2 to C6. CAR activity was coupled with that of an aldehyde reductase in Escherichia coli hosts to investigate the whole-cell bioconversion of eleven short-chain carboxylic acid substrates to their corresponding alcohols. Alcohol products were accumulated *in vivo* from short-chain carboxylate substrates at yields ranging from 0.5% and 71%. Engineered E. coli strains expressing CAR and aldehyde reductase enzymes were used for the de novo stereospecific biosynthesis of 1,2-propanediol (PDO) isomers. Our current research efforts focus on the engineering of CARs to improve the activities on short-chain carboxylate substrates.

QUANTITATIVE ANALYSIS OF DIALLYL SULFIDE IN TWO GARLIC SUPPLEMENTS.

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Alternative medicine is growing rapidly; one of the most popular forms being herbal medicine. With increased use of herbal and dietary supplements the chances for drug-herb interaction increases. It has been seen that an interaction can occur between prescription drugs and herbal medicines. Inconsistencies in the concentration of compounds in OTC supplements may interfere with a health care provider's ability to effectively prescribe to their patients. The purpose of this research is to test the concentration of diallyl sulfide found in extracts of over the counter (OTC) garlic supplements that may interact with prescription drugs. Evaluation of the consistency between formulations and manufacturing lots were made. For this study two different OTC garlic supplements were tested; Garlique and Nature Made. From each brand, two different manufacturing lots of each were tested. The methods that were used to perform this research were similar for both in that the capsules were

dissolved, centrifuged and filtered. They were then ran through the High-Performance Liquid Chromatography (HPLC). Results showed that qualitatively there is very little difference between the two lots of Garlique and the two lots of Nature Made and there were no differences between capsules within a lot. Quantitative analysis is currently being conducted on all samples.

EXAMINATION OF PAO1 BIOFILM COVERAGE USING FLUORESCENCE MICROSCOPY.

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Biofilms are groups of microorganisms that grow together on various surfaces such as medical equipment, metals, and human teeth. Given their community nature, biofilms have a unique ability to adapt and be more resilient to stress caused by a change in pH; or the addition of antibiotics. Biofilm growth can lead to a variety of health problems such as bacterial infections and are a particular area of concern for patients with implanted medical devices. The purpose of this study is to examine the overall coverage of PA01 biofilm growth on a glass surface and how that coverage might be affected by the presence of an adjacent modified surface.The biofilm coverage will be quantified using a combination of fluorescence microscopy and crystal violet assay techniques. The focus for this project in the next three months is in method development and analysis of biofilm coverage.

IMPACT OF GOLD SURFACES ON THE ATTACHMENT AND PROLIFERATION OF PA01 BIOFILMS.

Chris Huber*, Department of Chemistry, Doane University, Crete.

Once a bacterial biofilm attaches to a surface it often becomes very difficult to remediate due to an enhanced antibiotic resistance. Finding surfaces that inhibit the attachment of the biofilm becomes critical to the prevention of biofilm formation. The oligodynamic properties of specific metals such as Ag and Cu have been well studied, while the properties for other metals, such as Au, have not yet been established. In this study, a systematic approach was taken to elucidate the oligodynamic properties of Au. Specifically, Pseudomonas aeruginosa wild-type strain, PA01, biofilms were grown on glass slides, Au coated glass slides, and surface-modified Au coated glass slides. The biofilm growth was quantified using crystal violet (CV) assays, with the glass slide substrates serving as the control for biofilm growth. The assay data showed significantly less biofilm growth on the Au substrates (- 69%) but slightly more growth on the modified surfaces (+ 12%) when compared to glass slide controls. An additional growth study conducted on half-gold, half-glass slide substrates showed statistically similar growth to the expected average growth of Au and glass slide substrates.

MOLECULAR MODELING OF ISOFORM-SPECIFIC INHIBITION OF THE PEROXISOME PROLIFERATOR-ACTIVATED RECEPTOR PPARΓ: IDENTIFICATION OF PPARΓ ANTAGONISTS.

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The peroxisome proliferator-activated receptors (PPARs) are members of the nuclear receptor superfamily. The PPARs play important roles in transcriptional regulation of genes associated with lipid and glucose metabolism and inflammation. PPARγ ligands are divided into agonists, partial agonists, and antagonists. The agonists and partial agonists induce the transactivation of the receptor, and they are widely used in the treatment of Type II diabetes. In contrast, PPARγ antagonists can be used to treat and prevent prostate cancer and thus PPARγ is considered as a proved novel target in prostate cancer. In this work, we use docking and virtual screening methods to identify residues

important for antagonist binding and to identify new lead compounds. We identify key resides for interacting with PPARγ antagonists efficiently but inducing transactivation of the receptor. We now report results from a docking study of several PPARγ ligands to X-ray structures of PPARγ. We also identify three hit molecules with moderate binding affinity against PPARγ by virtual screening and biological test in a recombinant PPRE-Luc cell line.

OBSERVATION OF CARBON DIOXIDE CLATHRATE HYDRATE WHISKER STRUCTURES.

Avinash Kumar Both* and Chin Li Cheung, Department of Chemistry, University of Nebraska-Lincoln.

Gas clathrate hydrates are non-stoichiometric crystalline solids composed of molecular-sized water cages with encapsulated gas molecules. A wide range of different gas molecules such as methane, carbon dioxide (CO2) and hydrogen has been shown to form gas clathrate hydrates. Research on CO2 gas clathrate hydrates has received intense attention due to their application in CO2 sequestration. In this talk, we will discuss our observation of whisker-like CO2 gas clathrate hydrate structures and the basic mechanism behind the formation of these unique CO2 clathrate hydrates under specific laboratory conditions. We report our observation of the growth of whisker-like carbon dioxide (CO2) clathrate hydrate under moderate pressure (50 psi to 60 psi) of CO2 and low temperature (-60 °C to -70 °C). The composition and molecular structures of the observed whiskers were indirectly inferred from the vibration signatures of CO2 and water in the Raman spectra of these materials. A growth mechanism based on the "bubbling" CO2 from a dry ice substrate was postulated for the formation of whisker-like gas hydrate structures. We expect that our findings can improve the understanding of phase boundaries of gas clathrate hydrates and the nucleation of these whisker-like gas clathrate hydrate structures.

OPTIMIZING THE LINKER FOR LAT1-TARGETED PRODRUGS TO IMPROVE POTENCY AND CELLULAR UPTAKE.

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The membrane-bound protein L-type amino acid transporter 1 (LAT1, SLC7A5) is responsible for transporting amino acids such as tyrosine and phenylalanine as well as thyroid hormones, and it has been used to deliver drugs across the blood-brain barrier (BBB). LAT1 is also up-regulated in many different tumor types, and its expression levels have been correlated with prognosis. Amino acid-drug conjugates (prodrugs) have been shown to be transported into the brain via LAT1. However, the effect of linker chain length and functional group used in connecting drug to an amino acid promoiety has not been systematically studied. To address this question, we have prepared a series of benzoyl esters and amides attached to amino acid scaffolds of variable chain length. Analogs were then tested for LAT1 substrate activity in *cis*-inhibition and *trans*-stimulation cell assays. We will present the synthesis and structure-activity relationship (SAR) for these compounds. Our findings will help guide the design of LAT1-targeted prodrugs to treat brain diseases and cancer.

QUALITATIVE AND QUANTITATIVE ANALYSIS AND IDENTIFICATION OF MENTHOL IN PEPPERMINT TEA.

Princess Uba*, Tim Keith, and Jennifer Balmat, Department of Mathematical and Natural Sciences, Chadron State College, Chadron.

Peppermint products have been in high demand recently due to possible health benefits. Menthol is one of the major constituents in peppermint tea stabilizing compounds to prevent oxidation. The antioxidative properties may be helpful in humans. In this experiment, the levels of menthol in peppermint tea are measured via high-performance liquid chromatography (HPLC). The main purpose of this research is to find a consistency of menthol levels in the peppermint tea. The area of the HPLC peaks can be used to measure the amount of menthol present in the tea. Menthol concentrations can be used to compare different tea lots and brands. Regardless of the purported metabolic effect, predictable concentrations of menthol would be beneficial. For this study, Great Value peppermint tea was tested, and two different lots were the focus. Samples of pure menthol were used as a reference to quantify the menthol levels present in the peppermint tea. Preliminary results show consistency in the menthol peaks in the different lots of the Great value brand. Qualitatively, there are similarities between the menthol peaks but variations in the menthol levels present in the different lots. Quantitative data are still being analyzed and further study is ongoing for a second brand of tea, Bigelow, to consider the relationship between these two brands and to be able to make a comparison.

DOCKING STUDIES OF BOUND LIGANDS AND FDA APPROVED DRUGS FOR MAPKAP KINASE-2 (MK-2) AS POTENTIAL ANTI-FLU TREATMENT.

Michael Meyer* and H. Andy Zhong, Department of Chemistry, University of Nebraska at Omaha.

MAPK-activated protein kinase 2 (MK2) is an enzyme that is encoded by the MAPKAPK2 gene and activated by influenza virus infection. Cells that are deficient in MK2 have shown a decreased viral progeny. This paper presents our study on the MK-2 docking with bound ligands as well as the FDA approved drugs. Our results show that the free-energy method is able to predict the experimental binding affinity data with small errors. We also identify some FDA drugs that are able to bind to MK-2 with good docking scores (-9 kcal/mol or better) and thus would be considered as potential MK-2 binders.

STEREOSELECTIVE SYNTHESIS OF HOMOALLYLIC ALCOHOLS BY DOUBLE HYDRIDE REDUCTION.

Brianna L. Callahan and Martin Hulce*, Department of Chemistry, Creighton University, Omaha.

Homoallylic alcohols are widely useful in organic synthesis: important natural products themselves, they appear as sterols (cholesterol, campesterol, ergosterol) xanthopylls (lutein, zeaxanthin, cryptoxanthin), marine metabolites with anticancer potential (calyculin) and in perfumery materials. We have determined that sequential 1,2-, 1,4-hydride addition of hydridoaluminates to 3-alkynyl-2-cycloalkenones provides highly steroselective access to allene-containing homoallylic alcohols. Extension to a range of other homoallylic alcohols will be discussed: Regio- and stereoselective double hydride additions of various conjugated alkadienones results in mixtures of 3-alkenols and 4-alkenols favoring the homoallylic products.

FLUOROPHORE SUBSTITUTED 1,2,3-TRIAZOLIUM SALTS.

Connor A. Lejcher* and James T. Fletcher, Department of Chemistry, Creighton University, Omaha.

1,3,4-Trisubstituted-1,2,3-triazolium salts have been shown to display antibacterial and antifungal activity in a substituent dependent manner. The objective of this project was to develop triazolium salt analogs incorporating fluorophore units that demonstrate both potent antimicrobial properties and strong fluorescence emission. Realization of this objective may allow fluorescence microscopy to image the subcellular localization of such bioactive compounds. A family of 1,4-disubstitued-1,2,3-triazoles was prepared using a Sharpless-Meldal CuAAC 'click' reaction between aliphatic terminal alkynes and azidofluorophores, including 2-anthracenyl, 2-fluorenyl, 1-naphthalenyl, 2-naphthylenyl and 2-pyrenyl analogs. Substitution at the 3-position of each 1,2,3-triazole ring with benzyl bromide electrophiles resulted in 25 unique 1,3,4-trisubstituted-1,2,3-triazolium salts, which were typically prepared in 70-85% isolated yield. Minimum inhibitory concentration (MIC) assays were run against Gram-positive bacteria, Gram-negative bacteria and fungi to evaluate each antimicrobial properties of each compound. None of the triazole compounds were significantly bioactive, while the triazolium salts displayed MIC values that varied with substituent identity. The most potent MIC values observed were 0.4 μM against Gram-positive bacteria, 12.5 μM against yeast, and 0.8 μM against Gram-negative bacteria. Triazolium salt analogs displayed red shifted emission spectra compared to their triazole precursors, and emission signal strength generally increased for salt analogs relative to their neutral triazole precursors. Details regarding the synthesis, characterization, and antimicrobial assays of these compounds 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.

BIDENTATE CHELATORS WITH 1,2,3-TRIAZOLE AND ISOQUINOLINE SUBUNITS.

Nicholas W. Kreofsky* and James T. Fletcher, Department of Chemistry, Creighton University, Omaha.

This study describes the synthesis, coordination chemistry and antimicrobial evaluation of previously unreported bidentate chelators 1-(1-benzyl-1,2,3-triazol-4-yl)isoquinoline and 3-(1-benzyl-1,2,3-triazol-4-yl)isoquinoline. In these compounds the pyridine subunit of the commonly studied 2-(1-benzyl-1,2,3-triazol-4-yl)pyridine chelator is replaced by the isoquinoline heterocycle with varying regioisomer identity. The target chelators were prepared directly from 1- and 3-trimethylsilylethynylisoquinoline precursors using a tandem Sharpless-Meldal copper-catalyzed azide alkyne cycloaddition reaction in 87% and 80% yield, respectively. Each of these chelators was found capable of forming stable 3:1 Ru(II) complexes in 72% and 76% isolated yield (1- and 3-isomer, respectively) as a mixture of diastereomers observed by HNMR. UV-Vis analysis in methanol showed the emergence of a new low energy absorbance signature for each Ru(II) complex relative to its organic precursor (at 371 nm for the 1-isomer and 477 nm for the 3-isomer), indicative of a MLCT band strongly influenced by regioisomer identity. Antimicrobial evaluation of these complexes was performed using a microdilution minimum-inhibitory concentration (MIC) assay. MIC values for each of the isoquinoline complexes were observed to be 0.4 micromolar against Gram-positive bacteria, 31 micromolar against Gram-negative bacteria and 125 micromolar against yeast. In contrast, the analogous pyridine-containing complex showed only 25 micromolar activity against Gram-positive bacteria and >250 micromolar activity against Gram-negative bacteria and yeast. It was further determined that peripheral 1-triazole substituent identity and metal identity also significantly influenced MIC activity by preparing additional analogs of this motif. Details of the synthesis, spectroscopic characterization and MIC evaluation of these compounds will be presented.

CAVITAND-MEDIATED PHOTOCYCLOADDITION OF ARYL-ETHYLENES AND ITS APPLICATION IN MANIFESTING SUPRAMOLECULAR INTERACTION.

Mahesh Pattabiraman, University of Nebraska-Kearney, Kearney.

Cavitands are hollow, oligomeric molecules capable of encapsulating smaller molecules within their cavity. Chemists have employed them to encapsulate reactants within to manipulate physicochemical processes motivated by two main goals: (a) to achieve selectivity in otherwise non-selective chemical reactions (synthetic application) and (b) to exercise structural and constraints on molecules to study their behavior (fundamental science). Our group has employed the cavitand γ-cyclodextrin to study the bimolecular 2+2 photocycloaddition (PCA) of arylethylene with both aims in mind. PCA is an inherently inefficient reaction due to its bimolecular nature as well as the possibility to form four stereo- and regioisomeric products without selectivity. Encapsulating two arylalkenes within γ-CD greatly enhances its efficiency significantly. Moreover, product selectivity for a specific isomer in the reaction provides insight into the nature of supramolecular interactions and relative magnitudes of their effects. Our group is currently working on using this approach to qualitatively assess the relative strengths of π-π interactions and the effects of substituents on the interaction based on stereo- and regioselectivity. Towards this end, cinnamic acids, naphthyl cinnamic acids, symmetric and unsymmetrical chalcones have been explored. The oral presentation will feature the use of selectivity data, complex structure, and computational chemistry approach to understanding the nature of interactions between aryl ethylenes. In addition, we will present the utility of cavitand-mediated PCA of aryl alkenes for synthesizing diphenyl-dicarboxylic acid cyclobutanes.

THE HYDROPATHY SCALE AS AN EFFECTIVE PREDICTOR OF THE INFLUENCE OF AMINO ACIDS ON THE HYGROSCOPIC PROPERTIES OF SODIUM CHLORIDE AEROSOLS.

Joshua P. Darr*, Salvatore Gottuso, Mohammed Alfarra, David Birge, Kimberly Ferris, Dillon Woods, Paul Morales, Megan Grove, William K. Mitts, Eduardo Mendoza-Lopez, and Amissabah Johnson, Department of Chemistry, University of Nebraska at Omaha.

Sea spray aerosols are one of the most ubiquitous aerosols in nature and have important implications for health and the environment, in particular climate. While the hygroscopic properties of inorganic salt aerosols are well known, the influence of organic compounds on the hygroscopicity of the salt is still unclear. Using an infrared spectrometer coupled to a flow-cell apparatus, we have examined the hygroscopic properties of sodium chloride-amino acid aerosol mixtures. The hygroscopic properties of the mixture are found to be very dependent on the identity of the amino acid. Some amino acids such as glycine significantly affect the hygroscopicity of sodium chloride aerosols while others such as alanine have little to no effect. The hydropathy scale, a metric frequently used in biochemistry, is found to be a good qualitative predictor of the effect of the amino acid on the hygroscopic properties of sodium chloride.

CHEMISTRY AND PHYSICS

PHYSICS

MODELLING OPTICAL LIGHT CURVES OF AGNS USING VARIABLEVISCOSITY PARAMETER.

Shrey Ansh, Department of Physics, Creighton University, Omaha, NE 68718

AGNs are known to exhibit a highly stochastic variability at different time scales across all parts of the electromagnetic spectrum. It is difficult to ascertain if this variability at different time scales can be caused by a single mechanism. Lyubarskii in 1997 proposed a ‘variable alpha’ (viscosity

parameter) model to investigate 1/f power dependence of X-Ray light curves. Our project is aimed at investigating the output of optical light curves as a consequence of this variable alpha. We constructed a Markov Chain Monte Carlo simulation, where alpha which is oscillating at its local viscous timescale is introduced in the Shakura and Sunyaev ‘standard‘ accretion disc. Our theoretical prediction is then compared to the multi band photometric light curve observed in Sloan Digital Sky Survey. We investigated the variation in luminosity for black holes which differ in massand luminosity and compared that to our theoretical light curve obtained as a result of fluctuating alpha.

INCOHERENT PHOTOPRODUCTION OF Φ-MESON IN ULTRA-PERIPHERAL PB+PB COLLISIONS AT √S_NN = 5.02 TEV.

Amrit Gautam, Department of Physics, Creighton University, Omaha, NE 68718

The Large Hadron Collider (LHC) can accelerate fully ionized lead nuclei to near the speed of light. A Large Ion Collider Experiment (ALICE) is one of the detectors of LHC which observes the Pb+Pb collisions. During Run 2 at the LHC, the energy of 5.02 TeV per nucleon was achieved. An Ultra-Peripheral Collision occurs when the nuclei miss each other with an impact parameter greater than twice of the radius. As the range of strong force is shorter than this, we don’t observe any hadronic interaction. The purely electromagnetic interaction in ultra-peripheral collisions can be viewed as the exchange of virtual photons. When the source of the photon is due to the electromagnetic field of an individual nucleon it is called incoherent production. When an incoherently produced photon from one nucleus interacts with the other nucleus, vector mesons such as ρ, J/Ψ, Φ can be produced. We analyzed ALICE Run 2 data to observe incoherent production of the Φ-Meson in the K^+ K^- decay channel in ultra-peripheral events. In my talk, I will describe ultra-peripheral events, explain the techniques I used to analyze the data, and present my preliminary results.

SOFTWARE UPDATES TO STAR, THE SOLENOIDAL TRACKER AT RHIC RELATIVISTIC HEAVY ION COLLIDER), AT BROOKHAVEN NATIONAL LABORATORIES.

Emma Dufresne, Department of Physics, Creighton University, Omaha, NE 68718

STAR (Solenoidal Tracker at RHIC), a high-energy physics experiment at Brookhaven National Laboratory, analyzes the collisions of heavy ions traveling at relativistic speeds. The BBC Lecroy 1445A is a high voltage supply that provides power to many sub-detectors of STAR. The voltage and current of the high voltage input to the sub-detectors are monitored and controlled by graphical user interfaces, located in the controls room for STAR. There are alarms set in place for values that deviate by more than an acceptable margin of error from the expected values. This is mainly for safety reasons, but also the experiment must have consistent input for reliable data. Due to the age of the processor and the code it is running on, the software that monitors and controls the BBC Lecroy power supply needs to be updated. The old system is written in c-type code, while The new code is written in python, python can be used in object-oriented programming. and is easy to read and interpret, even if you weren’t involved in writing it. This talk will give an introduction to the BBCE Lecroy 1445A programs and discuss the proposed changes for improvement.

CONSTRAINTS ON THE GEOMETRY OF QUASAR SPECTRA.

Leo Moraczewski*, Jack Gable, Department of Physics, Creighton University, NE, 68178

Current models assume a quasar is an accreting super massive black hole, with an accretion disk feeding it at the center of a larger galaxy. The accretion disk is believed to be a rapidly rotating, geometrically thin but optically thick disk, which is perpendicular to the radio jets emitted by quasars. We exploring the geometry and the inclination angle of the accretion disk with respect to the observer.

The inclination angle can have significant effects on quasar emission, which has implications in other areas of quasar research. We present initial results of how the ultraviolet and visible spectra varies with the inclination of AGN accretion disks. We ultimately compare our model to data in the Sloan Digital Sky Survey.

BIG DATA ANALYTICS IN ASTRONOMY: APPLICATIONS IN QUASAR RESEARCH.

Samantha Hughes* and Dr. Jack Gabel, Department of Physics, Creighton University, NE 68102

The digital age has impacted virtually every scientific field, and astrophysics is no exception. Large scale sky surveys, such as the Sloan Digital Sky Survey (SDSS), Catalina Real-Time Transient Survey (CRTS), and the upcoming Large Synoptic Survey Telescope (LSST) are opening a new era in astrophysics. However, accessibility to a myriad of large datasets presents a unique challenge. In the age of information overload, how do we make sense of this unprecedented flood of information? In this presentation, I will discuss the benefits of melding astronomy with the power of computer science and the application of big data analysis techniques. I will also present the initial results in our study of quasar spectra in the SDSS spectral database.

SEARCH FOR HC PARTICLES IN HEAVY ION ULTRAPERIPHERAL COLLISIONS.

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We look at interactions between high energy lead nuclei during ultraperipheral collisions, where the smallest distance between the nuclei is at least their combined radii. This collision, mediated only by the electromagnetic interaction, may produce eta_c mesons which function as a probe for the theoretically predicted Odderon particle. The ALICE detector at the Large Hadron Collider can detect ultraperipheral collisions events by looking for the decay products of any particles produced during the collision. We seek to measure the interaction cross section of the eta_c meson during an ultraperipheral collision. Initial results from the Large Hadron Collider's Run 1 has yielded low statistics, but feasibility studies indicate that Run 2, performed at 5.02 TeV, may provide a definitive signal for the eta_c production. We discuss our analysis methods for measuring eta_c production and some preliminary results.

MATHEMATICAL MODELING OF CELL ATTACHMENT AND MIGRATION FOR PHYSICS OF CANCER.

Andrew Walther*, Michael Mimlitz, and Dr Andrew Ekpenyong, Department of Physics, Creighton University, NE 68102

Background: Physics of Cancer is a novel research frontier which seeks to unravel the role of physical interactions and mechanical forces in 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. It 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 a readout. Here, we present mathematical models for our vast experimental data which provide mechanistic insights into the role of various chemotherapeutic and radiotherapeutic approaches on cancer metastasis.

Methods: Having recently used a commercially available Electric Cell Impedance Sensor (ECIS) to quantify the migration of various cancer cell lines following chemotherapy and following

radiotherapy (using a cell irradiator, Faxitron), we applied both integer order and fractional order equivalent circuits to model the bioimpedance data, using MATLAB codes.

Results: Preliminary fits of equivalent circuit models are currently being done and results will be presented. Moreover, even without data fitting, we find that the irradiated HCN2 cells (neurons) and T98G cells (Glioblastoma, brain cancer cells) attach and migrate significantly more than non-irradiated cells in the first 20 hours post irradiation.

Conclusions: Owing to the multilevel complexity of biological systems and the growing intractability of diseases, especially cancer, our work addresses the urgent need for better modelling of living matter in the context of health and disease.

SIMULATIONS OF AGN OUTFLOWS AS ACCRETION DISK WINDS.

Margaret Johnston*, Jack Gabel, Department of Physics, Creighton University, NE 68102

Approximately 10% of observed active galactic nuclei display broad absorption lines in their spectra. The location of the gas responsible for these lines is not well constrained, the literature has distances ranging from several AU to several kpc. Photoionization models were used to better constrain the distance of this gas from the supermassive black hole. Accretion disk wind models of outflows have UV absorption lines as the main ejection mechanism of the gas. These models propose a region of shielding gas which reduces the x-ray flux to subsequent regions and allows the UV absorption mechanisms to take place. These models were explored to determine if they could accurately describe the observed characteristics of broad absorption line active galactic nuclei.

BALLISTIC TESTS OF MULTILAYERED ARMORED COMPOSITES.

Tyler Parthemer, Department of Physics, Hastings College, Hastings, NE 68901

Throughout the history of firearms and other projectile systems, projectiles have caused a tremendous number of deaths during warfare and in civilian settings. As a result, the development of body armor and other mechanisms has been the objective of many research endeavors. One of the most effective types of body armor is a multi-layered armor system. Multilayered armor systems have been shown to be more effective for ballistic protection against high velocity impacts in everyday military and police scenarios. Multilayered armors with a front ceramic followed by aramid fabric (Kevlar™) are currently used against high velocity ammunition. During this investigation, substitution of aramid fabric for natural burlap fabric along with substitution of carbon fiber fabric was the focus. Layering the three test materials with epoxy formed plies that composed the intermediate layers. Ballistic testing with 7.62mm and 9mm ammunition was performed with several combinations of materials for the intermediate layer of the armor. A cost analysis was performed to determine whether these new composite materials could be produced for significantly less expense than current armor systems. The objective of this investigation was to achieve similar ballistic performance to current multilayered armor systems with more economically and environmentally friendly materials while meeting the NIJ standards for ballistic armor.

DESIGN AND CONSTRUCTION OF AN ELECTRIC DRIVE SYSTEM FOR A DIRT BIKE.

Ashton Oakman, Department of Physics, Hastings College, Hastings, NE 68901

The internal combustion engine (ICE) revolutionized how we travel and how we perform many other everyday tasks. However, as battery technology and electric motors evolve, they have begun to take place of the ICEs. For my senior research project, I implemented the design and construction an

electric drive system for a dirt bike. The new drive system consists of a 10KW brushless DC motor powered by two 48V20Ah battery packs made of lithium batteries. I piezo generators are incorporated in the suspension for energy generation. I final design is a highly efficient electric motorcycle comparable to other electric motorcycles on the market. This research project allowed me to explore the capabilities of an electric motor and highly efficient batteries and to compare these capabilities to the original dirt bike outfitted with an internal combustion engine. Tests related to horsepower, torque, and battery life were performed. These values were compared to a similar production EV as well as the gas powered KX 125. A primary design goal during this research project was maintaining a lightweight bike similar to the original KX 125. Test rides of the EV were performed on a motocross track to compare the overall feel of the bike and its weight distribution with the original KX 125.

HEAVY-LIFT AUTONOMOUS DRONE.

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Drones have become an integral part of major advancements in many fields. Photography is a field in which drones are commonly used. In addition, drones are being used for atmospheric profiling, package delivery, search and rescue, and many military applications. Drones or Unmanned Aerial Vehicles (UAVs) can either be multirotor or fixed wing vehicles. A fixed wing vehicle is a small plane without a cockpit. A multirotor has a minimum of two propellers that work in such a way to allow for vertical take-off and landing. Most commonly these vehicles include four, six, or eight propellers. These are stable flyers as the speeds of these propellers are controlled by a computer; consequently, these machines remain stable in the air. Most are controlled remotely by a pilot with a controller that can adjust the overall thrust, yaw, pitch, and roll. These four controls allow for complete control of the UAV. Autonomy can then be accomplished with preprogrammed paths that allow the computer to take on these four controls to follow a certain path. An essential element for autonomy is to provide the computer with feedback from sensors. During this research endeavor, a new drone design was investigated. Experimental trials determined the limit of maximum lift while implementing autonomous flight with the use of proximity sensors. One outcome from the project is a drone prototype capable of perform numerous tasks in a variety fields.

ANALYSIS OF THE ACCURACY AND FIRE REPEATABILITY OF A HIGH VELOCITY RAILGUN.

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Railguns are electromagnetic systems that use a pair of parallel rails, a magnetic field and a large current to accelerate armatures (projectiles) to high velocities. The Lorentz force accelerates the armature after it is injected into the railgun. This force is created by the flow of electrical current through the armature interacting with the magnetic field generated by the current flowing through the parallel rails of the gun. Investigations of railguns started in the 20th century, but formal research into ordnance railguns did not start in the United States until 1977. One purpose of this research endeavor was to derive a theoretical value for muzzle velocity and compare it with experimental data for a high velocity railgun. The accuracy and ability to fire multiple times without failure were also investigated. It has previously been shown that repeated firings of a high velocity railgun causes rail erosion, hindering electrical contact and reducing the velocity of the projectile and the overall effectiveness of the system. However, how rail erosion affects the accuracy of the projectile has not been thoroughly studied. This project consisted of the design and construction of a high velocity railgun capable of withstanding multiple shots without malfunction in a controlled environment where velocity and shot group accuracy were measured.

PHOTOMETRIC ANALYSIS OF BLAZARS.

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A black hole is a region of spacetime with such a high gravitational pull that nothing can escape, not even light. Black holes are known to live near the center of galaxies, often orbited by millions of stars drawn to the strong gravitational force. This research project focused on a specific subclass of black hole galaxies called blazars. A blazar is a black hole that is positioned such that a jet of rapidly escaping matter points directly towards the Earth. The classification of blazars is relatively new, so there is a general lack of data related to these variable and powerful light sources. Investigation into blazars will yield new insights into fundamental questions in physics because the extreme force and speed of particles in a blazar's jet creates an intense and entirely unique situation that pushes the boundaries of relativity. Being directly in the jet's "line of fire" allows astronomers a glimpse into the heart of a black hole. This study utilized a 14" telescope and a CCD camera to take images of blazars during multiple sessions, each of which lasted several hours. These images were later analyzed for changes in light intensity. Blazars are known to be highly erratic, enabling a wide rage of variability to be detected in a relatively short time frame.

EARTH SCIENCES

INVESTIGATING THE ONSET OF THE CAMPANIAN–MAASTRICHTIAN BOUNDARY EVENT AT DSDP HOLE 762C USING CALCAREOUS NANNOFOSSIL BIOMTERICS AS A TEMPERATURE PROXY.

Shamar Chin* and David K. Watkins, Department of Earth and Atmospheric Sciences, University of Nebraska at Lincoln, 68588

The late Campanian through Maastrichtian was characterized by a long-term cooling trend that marks a transition from extreme greenhouse conditions associated with the mid-Cretaceous to cooler conditions that precede the Cenozoic climate. Calcareous nannofossils are sensitive indicators of surface water, making this fossil group a useful proxy for understanding Late Cretaceous climatic events.

This study expands on the postdoctoral work of Dr. Nicolas Thibault that explored the paleoclimatic evolution of Maastrichtian calcareous nannofossils from Deep Sea Drilling Project (DSDP) Hole 762C in the Indian Ocean. The completeness of its late Campanian–Maastrichtian record makes Hole 762C an ideal site for this study.

A total of 71 smear slides from DSDP Hole 762C, spanning approximately 74–72 Ma, were analyzed. Absolute abundances were determined by counting ~456 specimens and two additional traverses were scanned for rare species. In addition to the counts, 30 images were taken of randomly selected *Cribrosphaerella ehrenbergii* specimens. Biometric data for *Cribrosphaerella ehrenbergii* were collected by measuring each specimen along its longitudinal axis using Image Processing and Analysis in Java (ImageJ).

Traditionally viewed as a species with no known ecological affinities, *Cribrosphaerella ehrenbergii* appears to be responding to paleoclimatic changes at DSDP Hole 762C. More specifically, *C. ehrenbergii* seemingly increases in size at the onset of the Campanian–Maastrichtian Boundary Event (CMBE). The CMBE is a global climatic perturbation, marked by a negative carbon isotope excursion and cooler surface water conditions.

The literature shows that coccolithophores tend to decrease their coccolith and cell size to

adapt to cooler temperatures; however, it appears that *C. ehrenbergii* did not exhibit this biological adaptation. It is plausible that temperature change drove this size change, but data is needed from other ocean basins to corroborate this finding.

PALEONTOLOGY LOCALITY RECORDS.

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An examination of locality records from four large paleontology collection databases demonstrate that these catalogs store approximately 7 distinct locality names for each 100 specimens. About half of the localities in each database produced multiple specimens. The other half of the localities produced only a single specimen.

Most paleontological collections are now approaching a hundred years in age, and the nature of locality data has changed over that historical interval. Localities were initially recorded as either river basins or states. As the west was settled, town names became important. Government surveys made section, township, and range records possible. Today, individual specimens are collected with exceptionally precise GPS data that is plotted on Google Earth before the day is out. Historically, locality records have become more precise.

The assembly of locality records into a data source that brings the precision of modern geography to both recent and legacy locality records is not a trivial undertaking. Paleontological collections that contain 100,000 to 200,000 specimens may contain 10,000 localities that might to be integrated into the data source. My experience updating locality records suggest that it takes 15 minutes for a staffer to convert a single locality record. Because data conversion is expensive, data conversion needs to be focused on productive localities.

The locality databases of the future will undoubtedly be electronic. They will undoubtedly invoke the technology of Google Earth, which stores high impact point data in a .kml file with remarkable efficiently. They will also depend upon the open science initiative termed collaborative georeferencing within geographic information systems. At the same time that these data sources will have to anticipate then produce the types of data that end users will require of the database, they need to look backwards and explicitly specify data sources, the location of those data sources within the institution, and the methodologies used to bring that data up to current standards. Successful data discovery requires not only an appreciation of the historical context in which the specimen was collected and familiarity with the geographic area, but also some measure of luck. For this reason, locality databases require not only systematic updates, but also continuous maintenance.

A MOPHOMETRIC STUDY OF RABBITS FROM THE WHITE RIVER AND ARIKAREE GROUPS (CHADRONIAN THROUGH ARIKAREEAN) IN THE PANHANDLE OF NEBRASKA AND SOUTHERN SOUTH DAKOTA.

Maria Peterson* and Michael B. Leite, Department of Mathematical and Natural Sciences, Chadron State College, Chadron, NE 69337

The rabbits Palaeolagus and Megalagus first appear in the fossil record in the Chadronian and continue until the late Arikareean. Previous studies describe 9 known species in these genera. A morphometric study of 130 isolated teeth and partial dentitions from 14 Oligocene and Miocene localities in the Nebraska panhandle and Southern South Dakota has resulted in a better understanding of their diversity and variation in dental characteristics between species in this region. The specimens studied are from the collections of Chadron State College and the South Dakota School of Mines

and Technology. Results indicate that the species Palaeolagus haydeni is present at the Nebraska localities. P. philoi and P. hypsodus are present at the Miocene localities of South Dakota. Megalagus is not present in the Nebraska sample. Bivariate plots of transverse width vs. anterorposterior length of both upper and lower dentitions of Palaeolagus specimens show a weak positive stratigraphic trend, suggesting allometric tendencies. P. intermedius and P. hypsodus are both exceptions to this trend.

DETERMINATION OF HEAVY METAL SPECIES IN RESERVOIR SEDIMENTS OF THE PINE RIDGE-BLACK HILLS REGION, NEBRASKA AND SOUTH DAKOTA, USA.

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Elevated concentrations of heavy metals in lake sediments can lead to increased exposure of metal species to living organisms. High levels of trace elements in sediment may lead to bioaccumulation and trophic transfer, affecting the entire food chain. It is well established that geological, industrial, and agricultural factors all contribute to heavy metal accumulation in lake sediment. Previous studies on sediments of the Great Plains region have shown elevated levels of selenium, arsenic, and strontium in a downstream progression in the adjacent Republican and Solomon River Basins. Previous research has failed to analyze sediment metal trends in reservoirs of the Pine Ridge–Black Hills region. Sediment samples were collected from four man-made reservoirs (Box Butte, Chadron Dams, Whitney, and Angostura), that lie in a northern progression from Box Butte to Angostura. Due to the variations in geological formations of the regions that drain into the reservoirs, significantly different concentrations of metal species are expected. Sediment metal determination was done using a four-stage sequential extraction analyzing the following; (1) exchangeable and bound to carbonates, (2) reducible or bound to Fe/Mn Oxides, (3) oxidizable or bound to organic substances, (4) residual. This sequential extraction method enables examination of origin, bioavailability, and mobilization of the metal species as environmental conditions might enable. The extract was then examined for metal content with a flame atomic absorption spectrometer. Total metal content was determined by immediate introduction of the sediment into an aqua regia solution, skipping the sequential extraction. Preliminary data analysis indicates a significant difference in the metal content of Box Butte and the Chadron Dams compared to Angostura and Whitney reservoirs. Analysis of the data obtained in the sequential extraction procedure is ongoing.

THE CONTACT BETWEEN PEORIA LOESS AND THE GILMAN CANYON FORMATION IN THE KEARNEY AREA, SOUTH-CENTRAL NEBRASKA.

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The contact between the late Pleistocene Peoria loess and the underlying Gilman Canyon Formation (GCF) can be abrupt or gradual. Some studies have reported a “mixing zone” between the two stratigraphic units. In the Kearney area, the boundary between Peoria loess and GCF is subtle. Visually, there is a ~ 1 meter transition zone between clear Peoria loess and clear GCF. The zone is only slightly darker than the overlying Peoria loess (pale brown - 10YR6/3 compared to very pale brown - 10YR7/4.) The base of the transition zone is marked by a clear change to darker brown (10YR 5/4, 4/3) colors that are more typical of the GCF.

As a class project, we investigated this “transition” zone. We collected samples at 20-cm intervals from a portion of continuous core that was drilled through the Peoria loess, GCF, and into the underlying Loveland loess. Our total organic carbon and particle size data suggest that there is an observable boundary between the transition zone and the overlying Peoria loess. We submitted

two sediment samples from the transition zone for bulk 14C analyses. The samples from the upper and lower portions of the transition zone yielded calibrated 14C ages of 25,891 + 197 cal BP and 29,898 + 470 cal BP (2 sigma), respectively. The upper age corresponds with many published ages of approximately 25 ka for top of the GCF. Based upon the evidence for a contact and the 14C ages, we propose that the "transition" zone is actually the upper portion of the GCF.

SUDDEN SEISMICITY SPIKE IN CENTRAL NEBRASKA IN 2018.

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A sudden swarm of 27 earthquakes occurred in Custer County in central Nebraska in 2018. The equivalent moment magnitude for these earthquakes ranged from 2.7 to 4.1. Due to the lack of seismic stations in the proximity of the earthquake cluster, only six events have confident enough records to compute the focal mechanisms that show contradictory patterns of faulting – four are extensional with a SW-NE maximum stress orientation, while two are compressional with a SE-NW maximum stress. This talk summarizes the up-to-date information about the sudden earthquake spike in 2018, describes the historic seismicity in Nebraska, and outlines the relationships of the ongoing seismic activity with the reactivation of the old basement faults.

Two historic earthquakes clusters were identified in Nebraska. The first one occurred in Red Willow County between 1977-1982. That cluster included at least 32 earthquakes; it coincides spatially with the Sleepy Hollow Oil field. The second earthquake cluster out of eight events was active from 1982 to 1989 in Pawnee and Richardson counties in southwestern Nebraska; it appears to be related to the tectonically active Humboldt fault. The 2018 cluster is not aligned with any known active tectonic structure (the Cambridge arch is about 45 km to the southeast), and is at least 100 km away from the nearest petroleum operations.

The basement in the region of the sudden 2018 seismicity is approximately 1 km deep. The joint analysis of potential fields performed prior to 2018 allowed us to map the network of basement faults in the subsurface. The recorded seismicity cluster is well aligned with one of the interpreted faults. This observation, in addition to shallow earthquake depth (up to 5 km), suggests that the observed seismicity is related to reactivation of the shallow basement faults. However, the cause of this sudden reactivation remains unknown.

VARIATIONS IN SUBSURFACE SEISMIC VELOCITIES IN CENTRAL NEBRASKA DETERMINED FROM 2018 EARTHQUAKE CLUSTER.

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Nebraska is not considered a tectonically active region, however, in 2018 there was a sudden increase in earthquake activity. Overall, twenty-eight earthquakes were recorded throughout the state with twenty-seven of them tightly clustered near Stapleton, NE. The nature of the stress causing this recent swarm of earthquakes is still unknown. Previous studies have related the earthquakes to preexisting basement faults covered with approximately 3500 feet of sediments. These faults are associated with a Proterozoic failed Midcontinent Rift. The main goal of this study is to analyze the seismic records from this earthquake cluster to determine the spatial variations in seismic velocities of the subsurface rocks.

There are four professional seismic stations in the state of Nebraska. In July 2018, the United

States Geological Survey installed two more portable seismic stations in response to increased seismicity. For this project, records from all available instruments were analyzed for each earthquake. The P and S-wave arrival times were measured for all viable seismic records and velocities of the seismic waves were calculated. In addition, the first motion, whether up or down, was noted for all records to analyze the faulting style associated with each earthquake.

The results of this project are intended to provide a better understanding of the subsurface structures in the seismically active region of central Nebraska. The variations in seismic velocities imply inhomogeneity in subsurface rocks. Mapping this subsurface inhomogeneity may contribute to overall understanding of why this particular fault system is being reactivated.

GEOPHYSICAL ANALYSIS OF THE MIDCONTINENT RIFT'S SUBSURFACE STRUCTURES IN SOUTHEASTERN NEBRASKA.

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The Midcontinent Rift (MCR) is a 1.1 billion-year old failed rift system that spans much of the North American continental interior. Due to the presence of buried volcanogenic rocks, the MCR has characteristic highly-pronounced potential field anomalies (gravity and magnetic).

This study examines the MCR's northernmost boundary fault in Saunders County near Yutan, NE, by utilizing multiple geophysical surveying methods. The data were collected jointly by researchers from the Lincoln and Omaha campuses of the University of Nebraska. The geophysical surveying consisted of gravity, magnetic, and refraction/reflection seismic data acquisition along a north-south profile crossing over a predicted MCR fault. The goal of this study is to accurately image the subsurface structures by performing integrated analysis of data collected from multiple geophysical methods. In addition to the fieldwork performed in Yutan, the data from 16 exploration wells from the NOGCC (Nebraska Oil & Gas Conservation Commission) were used to constrain the model, which was also correlated with a published cross-section of southeastern Nebraska.

In total, 16 gravity and 42 magnetic measurements were collected along the profile. After applying all necessary gravity and magnetic corrections, there were pronounced potential field anomalies observed halfway across the profile, which were interpreted as indicators of a subsurface fault. Three seismic records were also collected over the inferred fault. However, the depth of penetration of these seismic experiments was too shallow to image the fault. The deepest boundary interpreted from the seismic results was the base of the unconsolidated sediments, the thickness of which agrees with published well data. The final cross-section model was developed from the joint analysis of the multiple geophysical methods. This project enables us to better resolve the subsurface structures of the MCR in southeastern Nebraska.

ASSEMBLING THE HUSKER SEISMOMETER.

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The main purpose of a seismometer is to record the ground motion as seismic waves are passing by. There are four professional seismic stations within the state of Nebraska, however they are expensive and sparsely located. A small, educational seismometer is currently utilized by the UNL Geophysics team for community outreach events. However, this instrument is not calibrated and thus

cannot be used for scientific research. The main objective of this project is to develop a low cost portable seismometer with SM-24 vertical geophone and Arduino based recording system that will yield better quality seismic records. At the initial stage of the project, the existing portable seismometers were reviewed. Then the prototype of the HUSKER seismometer was built and tested to ensure proper recording. The signal to noise ratio will be evaluated at the final stage of the project. As a result of this study, we anticipate to assemble a low-cost portable instrument that can be used for multiple research and outreach activities. Our future goal is to assemble several more HUSKER seismometers and distribute them among public schools within the state of Nebraska.

DEVELOPING A DRONE-BASED MAGNETIC FIELD SURVEYING SYSTEM.

Erik Jacobson*, Irina Filina, Department of Earth and Atmospheric Sciences, University of Nebraska at Lincoln, NE 68588

Recently unmanned aircraft systems, or drones, have advanced to carry payloads in order of 10 kg and deploy to within 5 km of the pilot. These capabilities have enabled geoscientists to mount magnetometers onto drones to acquire magnetic field data at relatively slow flight speeds and low flight altitudes. The main objective of this project is to develop a low cost drone-based system to conduct fast and high resolution aeromagnetic surveys. The project consists of several steps. First, review existing drone platforms and their capabilities in order to select an appropriate system to carry the Scintrex ENVI-PRO magnetometer with total weight of 3.45 kg. Next, design a proper mounting style to ensure a correct orientation of the magnetic sensor during flight. A series of test flights is planned to confirm repeatability of magnetic readings. Finally, the results of our airborne survey will be compared with land-based measurements. The drone-based magnetic field surveying system will allow data acquisition over areas that are not accessible for ground based measurements, such as the corn fields of Nebraska.

ENVIRONMENTAL SCIENCES

BERGMANN'S RULE TESTED ON SNAKES NATIVE TO THE UNITED STATES AND CANADA

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Bergmann's rule is a principle stating that populations and species within similar taxonomic clades that reside in colder climates will have larger body sizes as opposed to animals living in warmer climates. Although it has been tested on birds and mammals across the globe, little is known regarding whether or not it applies to other groups of animals such as reptilians or fish. This research questions if Bergmann's Rule applies to North American and Canadian snakes. Data collected about 131 different species of snakes in these countries include clutch sizes (average and maximum), maximum body lengths, and geographic locations. After the collection of data, a regression test was performed to test the correlation between snake body size and climates. This study presented no significance between the two variables, providing evidence that was able to show that Bergmann's rule, a theory made for endothermic animals, doesn't necessarily apply to reptilian species within North America, but could have potential for other species across the globe.

DEVELOPING AN EXTRACTION METHOD FOR HPLC DETECTION OF ARTHROBACTER AURESCENS TC1 ATRAZINE BIOREMEDIATION

Hunter Kleinschmidt, Jared Hass, Michael Kangas, Christopher Wentworth, Chris Huber, Andrea E Holmes, Arin L. Sutlief*, Doane University, Crete, NE.

Bioremediation currently serves as one of the most widely used and efficient methods for

removing contaminants from water resources, such as water treatment plants. Through this method, bacterial strains are capable of metabolizing compounds offering the ability to target specific contaminants. Interest in the removal of atrazine, a herbicide commonly used in the US, has grown due to contamination in areas of high agricultural activity. Previously, our studies have demonstrated Arthrobacter aurescens TC1, a soil dwelling bacteria, capability to metabolize atrazine in suspended cultures, but injecting atrazine containing media samples directly into the HPLC column caused clogging by media components that could not be resolved with the several methods explored. In this work, an alternative HPLC method for atrazine detection was created to reduce column degradation while preserving the analytical nature of our atrazine detection. By using an extraction method, atrazine was removed from media samples prior to HPLC injection. This method development lead to further experiments for the understanding of atrazine degradation by Arthrobacter aurescens.

PHYTOREMEDIATION OF HEAVY METAL CONTAMINANTS

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Heavy metal pollution in soil systems has been shown to have a detrimental effect on soil biota and fertility. Soils polluted with high concentrations of heavy metals pose a threat to human health because of their known cytotoxicity, mutagenicity, and carcinogenicity. Soil samples were collected and measured for copper and lead contamination. Seeds of *Raphanus sativus* and *Avena sativa* were planted in collected soil, standard potting mix, potting mix containing copper chloride, or potting mix containing lead chloride. Plants were grown in a controlled environment. Above-ground plant biomass was dried and copper or lead ions were measured using atomic absorption spectroscopy. Soil heavy metal content will be compared with plant uptake to examine the potential of phytoremediation for site rehabilitation.

HABITAT SELECTION AND SPATIAL DISTRIBUTION OF EASTERN COTTONTAIL RABBITS IN A FRAGMENTED AGRICULTURAL LANDSCAPE.

Jourdan M Ringenberg*, Nate Bickford, Matt Bice, and Dustin H Ranglack, Department of Biology, University of Nebraska at Kearney, NE 68849

Knowledge about wildlife space use in response to environmental and climatic changes is necessary to conserve vulnerable species. Specifically, with further understanding of how species utilize the landscape, we can better manage their populations in hopes to provide a more symbiotic relationship between humans and wildlife. Rabbit species act as ecosystem engineers, as they perform behaviors that benefit other species and often their populations can be an indicator of ecosystem health. Understanding how ecosystems are impacted by climatic and environmental changes will prove necessary in the human population's adaptation to these changes. Eastern cottontail rabbits (*Sylvilagus floridanus*) live among us in a plethora of environments, yet little is known about their use of space across fragmented, agricultural landscapes or how they respond to habitat modifications and climate variances. As the climate continues to change and landscape modifications are in full force, the spatial distribution of rabbit populations will likely shift in response. We investigated the spatial distribution and habitat selection of eastern cottontails in fragmented farmland in south-central Nebraska. We captured and outfitted rabbits with radio-telemetry collars and tracked their movements for the duration of a year (dates maybe). Additionally, we collected vegetation and local weather data to analyze further potential factors that may influence the spatial patterns of rabbits. Utilizing remotely sensed imagery, we were able to plot rabbit locations in ArcGIS and determine patterns of habitat preference. Our initial findings suggest that rabbits utilize available habitat differently between the crop-growing and non-growing seasons. We believe this is in response to availability of protective cover and food resources that cropland offers in the growing

season. Thus, proper management for rabbits in fragmented agricultural landscapes may include providing protective cover and opportunities to connect between fragmented habitats in the non-growing seasons.

TEACHING OF SCIENCE AND MATH

ADDING RELEVANCE TO A NONMAJORS BIOLOGY COURSE.

Phyllis Higley, College of Saint Mary, Omaha, NE.

Survey Biology is a course offered to students taking biology to meet general education requirements. Typically, Survey Biology courses cover a breadth of material that, for biology majors, would be presented in several different courses. Presenting these topics in one course means that the content is very superficial, somewhat esoteric, and at the same time difficult to learn. I teach a Survey Biology with an enrollment of approximately 20 female students from a diversity of majors. I have redesigned my Survey Biology course to cover a limited number of topics that provide the foundation to understanding current-day biology concerns. My goal is to ensure that students learn biology that is relevant in their lives, and that they build a knowledge base on which they can build. By learning some core biology concepts they will be able to better understand biology-focused news articles and to research their own biology topics of interest. To help meet this goal I assign oral presentation topics for the students to research and present to the class. In this way the students both apply their newfound knowledge and gain access to new topics of biology. At the same time the class as a whole learns new information.

APPLICATIONS OF A RANKING TASK EDITOR IN ASTRONOMY EDUCATION.

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Ranking tasks are interactive formative assessment tools which ask students to order a set of items based upon specified criteria. Examples span ordering the planets in our solar system by increasing orbit size or density, to ranking colors in order of decreasing wavelength or energy. Ranking tasks are flexible tools for educators useful in a variety of teaching methods (including flipped pedagogies). Educational research illustrates that they are beneficial to students in introductory astronomy by reinforcing student understanding of numerous topics. An editor for easily creating ranking tasks for computers and mobile devices has been developed at the University of Nebraska-Lincoln and is publicly available on the http://astro.unl.edu web site. Recently created ranking tasks will be demonstrated that are already being implemented in the pre-class online lectures of an introductory astronomy course. The capabilities of the editor are substantial in its present form and additional features will be added in the future. This project is funded by the NASA Nebraska Space Grant.

GROWING PATHWAYS TO STEM: USING RESEARCH FRAMEWORKS, COMMUNITY PARTNERSHIPS, AND INTENSIVE MENTORING TO EXPAND STEM CAREER PATHWAYS FOR RURAL COMMUNITY COLLEGE STUDENTS.

Lauren M. Gillespie* and Steve Heinisch, Department of Academic Education, Central Community College, Columbus, NE. Neal Grandgenett, Department of STEM Education, College of Education, University of Nebraska-Omaha, NE.

Best known for degrees and certificates in engineering, technology, computer science, or manufacturing areas, community colleges play integral roles in education pipelines of clinical, biomedical, and public health occupations, many of which require a baccalaureate and/or other

advanced degree. Community colleges are necessary for the continued evolution of future generations of scientifically literate citizens and help prepare undergraduate STEM students for entrance into globally-competitive workforces. Production of individuals valuing and utilizing quality education in STEM areas in rural states is imperative at a time when scientific literacy is critical to global and public health. Here, we describe a National Science Foundation funded scholarship program investigating outcomes of relationships between student-cohorts, mentors, and local industries. Central Community College-Columbus is one of select community colleges awarded in the NSF S-STEM funding initiative. This is largely due to college-industry partnerships, and an established internal funding program. These opportunities bridge established gaps to low-income, high-achieving student success and retention in STEM. 'Project GPS' (Growing Pathways to STEM) provides students development of applied, critical thinking skills, fostering resilience, and utilizing teamwork and creativity through 1) exposure to empirical engineering and avian research, 2) multi-institution, interdisciplinary collaboration, 3) unique exposure to professional development activities and paid internship opportunities, and 4) a wholistic-mentoring perspective tailored to realities community college students face. Establishment of similar programs in rural areas may increase access to science education while examining barriers to STEM success in first and second-year college students relatively independent of financial burdens and academic prowess.

WHAT CURRENT RESEARCH CAN TEACH MEDICAL PERSONNEL ABOUT SEPSIS MANAGEMENT AND TREATMENT.

Emily Klein*, Britta Robinson, Ashley Holm and Bri Aguilar. Bryan College of Health Sciences, Lincoln, NE.

Do patients diagnosed with severe sepsis who are treated with hydrocortisone, thiamine, and vitamin C have a better prognosis than those treated with the current standard practice? Through extensive searching of the Cochrane Collection, PubMed, and the Bryan College of Health Sciences Library, this medication regimen effectiveness was analyzed. To research this regimen, three primary research articles were chosen. Because this topic is new, available research was limited. Criteria for the primary article included the full medication regimen, a critical care setting, and the diagnosis and prognosis of sepsis. Additionally, one systematic review was chosen that analyzed the effectiveness of hydrocortisone in the treatment of sepsis. To supplement the article and systematic review, a critical care nurse was interviewed. With over 30 years of experience in the intensive cardiac unit at an urban hospital, she detailed her experiences with sepsis and shared that this protocol has been in discussion at intensive care conventions. Through research, we found that this protocol decreased mortality by 32%, decreased the need for dialysis by 17%, and decreased vasopressor use by an average of 35 hours. Ultimately, the current research on this medication regimen shows great potential in benefiting patient outcomes.

USING DEMONSTRATION VIDEOS.

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The Astronomy Demonstration Video Project is an NSF-funded effort to create videos that are centered on physical demonstrations and illustrate concepts important in introductory undergraduate astronomy and physics classes. Over 30 short videos are presently available, many with interactive components. These components include embedded peer instruction questions and follow-up worksheets. These interactive materials follow the recommendations of educational research to maximize student learning from demonstrations. The videos are intended to work well in a large classroom environment. Video projection makes the demonstrations easily visible while the demonstrations are

well-executed and the videos are edited such that the demonstrations make efficient use of class time. The demonstrations are often supported with other technologies such as computer simulations and IR camera footage. The videos are also sufficiently flexible to be used successfully in smaller groups or in individual settings as students are asked to either vote with a clicker device or to record their vote and explanation on paper. They should appeal to instructors who do not have access to the demonstration equipment used or are teaching in blended, flipped, or distance education environments. The videos are hosted on YouTube (UNL Astronomy channel) and on the Astronomy Education web site at the University of Nebraska (http://astro.unl.edu). This project is funded by NSF award #1245679.

MAKING "SCENTS" OF ESTER CHEMISTRY: DEVELOPING A SOPHOMORE ORGANIC CHEMISTRY LABORATORY.

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A combinatorial chemistry-based investigation of the organoleptic properties of 38 naturally occurring esters of formic, acetic and propionic acids was designed for the sophomore organic laboratory. Fisher esterification of equimolar amounts of various carboxylic acids and primary alcohols gave a library of esters which were assayed for purity using infrared spectroscopy and purified as necessary using a sodium carbonate-alumina microcolumn. 10 volume percent solutions of each carboxylic acid, alcohol and ester were prepared in dipropylene glycol. 500 μL aliquots of each solution were placed in clean, capped vials and the odor profiles recorded. Library generation, odor profiles and trends will be discussed.

COLLEGIATE ACADEMY

BIOLOGY

SESSION A

USING HYBRIDIZATION AND SELECTION TO EFFECTIVELY DEVELOP IMAZAMOX-RESISTANT WHEAT.

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Triticum aestivum, commonly known as wheat, will be an important staple crop in years to come as the global population continues to rise. Wheat offers a food supply to sustain the Earth's population growth, but current yields will have to increase dramatically. Imazamox-resistant wheat varieties offer the option of farmers to use herbicides while not harming the wheat crop, and the University of Nebraska in Lincoln wheat breeding program attempts to achieve this through using hybridization of wheat lines that are both resistant and possess other desirable traits. To attain this objective, the present study rated the resistance of the F4 (fourth generation) of imazamox-resistance lines within the program to determine if the selective processes of the program were effective in giving the fourth generation a higher percentage of resistant wheat lines than the third generation (F3). Then Chi-Squared analyses were run for each of the 30 populations sampled. The results of the experiment showed that 7 populations showed a higher percentage of resistance in the F4 when compared to the F3 generation. 23 populations were found to not have improved-resistance ratios. The results indicate that the current selective procedures within the program are not adequately advancing resistant wheat lines. The program should look into genetic selection procedures and more intentional communication to avoid misplantings and sample confusion concerning lines.

MICROPLASTIC POLLUTION IN SALT CREEK SURFACE WATERS: QUANTITY AND COMPOSITION.

Margaret A. Eubanks*[1], Jerald S. Bricker[1], Shannon L. Bartelt-Hunt[2], and Daniel D. Snow[2], [1]Department of Biology, Nebraska Wesleyan University, Lincoln, NE 68504, [2]University of Nebraska – Lincoln

Plastic production has increased substantially over the last 70 years adding a level of easy to people's everyday lives. These cheap alternatives can be found in everyday items, such as plastic bottles, electronics, such as cell phones, and building and packing material, such as PVC piping. Researchers have studied the decomposition properties of these different types of plastic finding that they degrade into smaller and smaller pieces called microplastics, but never fully decompose like other organic materials do. Microplastics have been found in many different water systems including salt and fresh water and at many different depths including surface waters and deep-sea waters as deep as 4843 meters. This research focuses on the possibility of microplastics coming from waste water treatment plants and therefore household waste water sources. Samples were collected upstream and downstream of the Theresa Street Water Resource Recovery Facility in Lincoln, NE. All four samples downstream and all four samples upstream contained microplastics showing a high prevalence coming from the effluent of the waste water treatment plant. Microplastics collected in this research will be used for further testing of polymer type and prevalence of heavy metals.

TRANSCRIPTOME ASSEMBLY AND DIFFERENTIAL GENE EXPRESSION ANALYSIS OF THE COMMON CORN SNAKE, PANTHEROPHIS GUTTATUS.

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Locomotor performance is a complex phenotype involving coordination between many genes participating in both metabolic processes and skeletal muscle function. Snakes are good model organisms to examine locomotion and musculature due to their variety of locomotor modes and metabolic adaptive changes. Differential RNA expression of several corn snakes (Pantherophis guttatus) was studied to investigate these locomotor modes and examine any gene expression level changes using a variety of de novo and genome-guided transcriptome assemblers. This study aimed to examine differentially expressed gene levels during modes of locomotion and relate the changes to variation in performance, energetic costs, and metabolic rate.

THE ADAPTIVE FUNCTION OF COTTONTAIL RABBIT (SYLVILAGUS FLORIDANUS) TAIL-FLAGGING USED TO AVOID PREDATION.

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Anti-predator behaviors are crucial for survival and successful reproduction in many animals. One such behavior thought to be important for a number of mammal species is tail flagging. Though tail flagging has been examined in a few species, such as whitetail deer (Odeocoileus virginianus), the potential adaptiveness of the behavior has not been studied in cottontail rabbits (Sylvilagus floridanus). By visiting numerous nature reservoirs and parks, we recorded the natural behavior of the rabbits with and without the presence of a predator to examine whether tail-flagging varies according to predation risk. In the presence of a human 'predator', our protocol was similar to Caro et al (1995). Once the animal was located, contextual variables were recorded including: distance to refuge, other animals present, weather, and distance from 'predator.' Then the 'predator' would approach the animal, stopping once the animal starts to flee and tail-flagging behavior can be observed and recorded. We also

recorded the behavior of rabbits chased by other conspecifics and those moving freely on their own. We hypothesized that tail-flagging is a voluntary behavior used to reduce the likelihood of being captured by a predator. We found the increased degree of tail flagging is positively correlated to increasing flight speed (m/s) only in rabbits chased by a predator, supporting the idea that tail flagging is adaptive and not merely biomechanical.

EFFECTS OF A LARGE MEAL ON THE LIMBLESS LOCOMOTION OF THE COMMON CORN SNAKE (PANTHEROPHIS GUTTATUS).

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Limbless locomotion has evolved more than sixty times in lizards and snakes. This loss of limbs has required species of snakes to develop new modes of locomotion to successfully capture prey, avoid predators, and locate potential mates. We hypothesize that a large meal will hinder the ability of the snake to move and therefore their speed will decrease after eating a large meal. Only four modes of locomotion were studied: arboreal, lateral undulation, swimming, and concertina. Twenty-one panterophis guttatus were split into three treatment groups that were based on the number of mice they were to eat in the second week of the experiment, with a control group not eating any mice. The first week of the experiment the snakes were not fed and ran on a track that was designed for their specified mode of locomotion. During the second week of the experiment, the snakes were fed their designated number of mice and then ran on the track that they were ran on the week prior. It was found that there was only a statistically significant relationship between the size of prey eaten and the mode of locomotion, with concertina being the most significant. The size of the prey would heavily constrict the amount of bending that could occur during locomotion and because snakes rely on bending to move, this would make their speed decrease significantly, which is what we observed.

THE EFFECTS OF CAFFEINE AND EXERCISE ON ULNAR NEURAL IMPULSE SPEEDS.

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Neural impulses, or the progressive physicochemical change in the membrane of a nerve fiber that follows stimulation and serves to transmit a record of sensation from a receptor or an instruction to act to an effector, are key to effective bodily communication. With that being said, the speed at which these impulses are transmitted are directly related to physical and cognitive functioning, and neurotransmitters – microscopic chemical molecules – are the initiating factors that lead to effective propagation of nerve signals from dendrites to axons of nervous tissue. Previous research has shown that both caffeine and exercise increase the physiological concentration of circulating neurotransmitters, but has never been analyzed on the basis of neural propagation speeds. Therefore, it is the purpose of this study to determine if the administration of caffeine prior to exercise has an effect on neural propagation speeds when compared to caffeine or exercise only trials. Fifteen participants for this study were collected on a volunteer basis from the University of Nebraska Wesleyan, and divided into four testing groups: control or resting, caffeine only, exercise only and caffeine coupled with exercise – and analyzed for their respective neural propagation speed per trial. An ANOVA was performed once data collection was complete, revealing a significant difference in neural propagation speeds of the caffeine plus exercise group, when compared to resting, caffeine and exercise only groups. As the specific biological mechanism which underlies these findings was not found during this study, only a correlation between variables can be made. Thus, future research should be focused on neurotransmitter serum levels – when caffeine is given or exercise is performed – as this would give researchers quantitative data on the potential link between neural propagation speeds and factors that might increase physiological communication.

SESSION B

EVALUATION OF THE "TAIL DROP" HYPOTHESIS IN HUMAN CHASED SYLVILAGUS FLORIDANUS IN NEBRASKA.

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Tail flagging is a well-documented phenomenon in ungulates, and although some evidence supports it having a role in anti-predator behavior, there is no true consensus on tail flagging's functional significance. Tail flagging behavior is not limited to ungulates and has been observed, though not well studied, in other animals including squirrels and rabbits. The goal of the current study is to investigate tail flagging as an anti-predator response in cottontail rabbits (Sylvilagus floridanus). We hypothesize that tail flagging serves as a signal aimed at the predator, which is subsequently dropped after flight to obscure the rabbit's location, which would function to confuse the predator. Wild rabbits, at several locations in Lincoln, NE, were approached by a human on foot at varying speeds. Flight initiation distance was recorded and tail position during and at the end of each flight was documented using a numerical store. Preliminary results support the hypothesis that rabbits frequently signal and then drop the tail upon entering refuge. Results of this study provide insight into prey-predator communication, specifically the role of prey signaling as an antipredator response.

AGGRESSIVE PREWARMING MEASURES DECREASED PERIOPERATIVE HYPOTHERMIA IN OUTPATIENT SURGERY CENTER PATIENTS.

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Perioperative hypothermia is a common, yet preventable, complication of surgery. Side effects of hypothermia include, but are not limited to, increased infection rates, myocardial ischemia, and lengthened recovery time. Maintaining a core body temperature within normothermic range determines a surgical patient's overall success. Aggressive warming measures are essential to conserve a patient's body heat while under the effects of anesthesia. This study conducted found that prewarming the patient prior to sedation will stabilize a normal core body temperature that will be more easily maintained during surgery. Aggressively prewarming surgical patients will lower the overall risk of perioperative hypothermia.

THE EFFECTS OF CAFFEINE ON BRAIN ACTIVITY POST-EXERCISE.

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Studying brain activity is becoming an increasingly popular area of research. The specific brain waves correspond to different mental states of the brain. Since beta wave activity is generated when the brain is aroused and engaged, it will be the primary brain wave studied. Of important note, when the brain is stimulated to the upper limit of beta brain wave activity (22-38 Hz), it has been associated with stress and anxiety. Previous research has shown that caffeine and exercise induce changes in beta brain activity; however, these two variables have not yet been paired simultaneously. The purpose of this research study was to determine whether the administration of caffeine prior to exercise has an effect on brain wave activity levels compared to when only using caffeine or only performing exercise. Fifteen male and female students from Nebraska Wesleyan University volunteered to participate. The trials were divided into four testing sessions, consisting of a control group, a caffeine only group, an exercise only group, and a caffeine and exercise group. At the time of abstract submission, results

were still being gathered. From referencing the literature, we expect the results of this investigation to reveal a difference among the four testing sessions. The caffeine and exercise group is predicted to have increased beta brain wave activity compared to the other sessions. This investigation revealed the effects of caffeine on brain activity post-exercise, but also hints that this practice may not be healthy long-term. Future research should continue to explore what fluctuations in brain wave activity indicate in terms of overall health of the brain. An intriguing new area of research, neurofeedback, is gaining support to be integrated into counseling and practice. It consists of biofeedback training for the brain that ultimately allows individuals to self-regulate brain wave activity.

EFFECTS OF LEG POSITION AND TIME ON THE LOCOMOTION OF SPIDERS (PHOLCUS MANUELI) AFTER AUTOTOMY.

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Autotomy, the self-amputation of an appendage such as a tail or leg, is used as a defense mechanism in many species to escape predation. Though the immediate benefit to autotomy is the ability to escape a predator, the loss of a limb could have long term negative influences on survival and reproduction by hindering locomotor performance. To determine the long-term effects of autotomy on cellar spiders, 60 individuals were divided into three treatment groups: Control, front leg (L1/R1) removed and back leg (L4/R4) removed. Trials included a pre-autonomy run of all spiders conducted and videotaped 1 week prior to autotomy, as well as trials conducted weekly over 12 weeks to measure speed, stride length, and stride cycle time. We found that both treatment groups decreased in speed following autotomy, but experienced improved performance over the trials. They also showed a significant difference in locomotor speeds between L1 and L4 spiders. L4 spiders were only able to partially compensate for decreased speed by relying on improved stride cycle times. This result was unexpected but supports the hypothesis developed during other experiments, that the back legs play a larger role in force exertion during locomotion, relative to the other legs.

MUNICIPAL WASTEWATER AS A SOURCE OF MICROPLASTIC POLLUTION IN SALT CREEK SEDIMENTS.

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Though the vast majority of microplastic research has been directed toward the marine environment, most plastics are manufactured, used, and disposed of on land. With rivers acting as a primary conduit for plastics to travel from land to sea, this work examined a municipal wastewater effluent as one pathway for microplastics to enter the aquatic environment. Six riverbed sediment samples were collected near the Theresa Street facility in Lincoln, NE. Sites upstream had a low abundance of microplastics relative to downstream, though there was no significant difference. The results revealed that the Salt Creek riverbed currently suffers little from settled microplastics, not yet becoming a hotspot for microplastic pollution beneath the water column.

EFFECTS OF PEDIATRIC CONGENITAL HEART DISEASE ON KBIT-2 SCORES COMPARED TO HEALTHY CHILDREN.

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Pediatric congenital heart disease is the most prevalent birth defect diagnosed in newborns,

affecting 40,000 births per year in the United States. Working with the TIPS follow-up clinical program, research was conducted to assess children's verbal and non-verbal development. The purpose of this study was to examine the disparity between children with CHD compared to children without CHD. A retrospective cohort study was conducted, consisting of 57 children diagnosed with CHD. The Kaufmann Brief Intelligence Test was used to measure verbal and non-verbal intelligence. Three subsets were tested including verbal knowledge, matrices, and riddles. Raw scores were obtained from verbal knowledge and riddles, and were combined to give a composite verbal score. The matrices subset was totaled to indicate the raw nonverbal score. Raw scores were converted to standardized scores using the KBIT-2 testing booklet at a 90% confidence interval. IQ composite means were found to be 92.7, indicating an average score relative to the general population for the CHD children's age range, although on the much lower spectrum across ranges. Range difference of IQ composite scores shows sizeable difference between the upper and lower extremes, indicating children with CHD may have substantially lower KBIT-2 IQ scores compared to the healthy group's average. 33.3% of children with CHD fell into the below and well below average range for IQ, 13.3% for verbal, and 26.7% for nonverbal subsets. A total of 37.8% of children diagnosed with CHD were in the below average – lower extreme descriptive category. The results communicate that children with CHD showed decreased scores in verbal and nonverbal KBIT-2 test scores. Results show there is some form of correlation observed between CHD and slowed development of patient's verbal and nonverbal cognitive skills. Further studies should be conducted to investigate disparities in verbal/nonverbal skills that may affect cognition and learning.

ESCHERICHIA COLI CAUSING URINARY TRACT INFECTIONS AND DIARRHEAL DISEASES.

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Escherichia coli is a leading cause of urinary tract infections and diarrheal disease and the strain causing the infection resides in the individuals own colon. Most uropathogenic E. coli strains express virulence factors such as p. fimbria, mediating adherence to colonic and urinary tract epithelium. The colonic microbiota has been suggested to be a reservoir for transferable antibiotic resistance factors. The goal of the study is to determine the relationship between the presence of uropathogenic virulence factors and antibiotic resistance profiles in E. coli isolated from students. Infections are on the rise along with finding ESBL E. coli in an individual's rectum. Samples for rectal E. coli were taken and the DNA strands were analyzed using PCR. The greatest antibiotic resistance was found in penicillin, ampicillin and oxacillin with adhesion factors as the most common virulence factor followed by siderophores. More samples are needed to determine if E. coli but the presence of ESBL giving it high probability of causing greater infection.

EFFECTS OF CAFFEINE COUPLED WITH EXERCISE ON GRIP STRENGTH AND REACTION TIME.

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Caffeine is utilized by millions of people on a daily basis. Some of the people that use caffeine are also exercising, either recreationally or competitively. Certain caps for caffeine consumption prior to exercise are in place for competitive athletics due to the possible "edge" that caffeine presents to the athlete's performance. We aimed to determine whether the consumption of caffeine, when coupled with exercise, would result in a difference in grip strength and reaction speed when compared to resting (no caffeine or exercise), caffeine only, and exercise only situations. A total of 15 volunteer participants from Nebraska Wesleyan University were part of our research. All participants were ultimately a part of all

4 groups (resting, caffeine only, exercise only, caffeine coupled with exercise) throughout the testing process. Each participant was administered an 8-ounce cup of water regardless of which group they were a part of on the particular testing day. According to Mayo Clinic, up to 400 milligrams of caffeine per day seems to be safe for most healthy adults. With this in mind, caffeine was administered in an amount of 3.00 milligram per kilogram of body weight for each individual. Participants over 90 kilograms were excluded from the selection pool in order to ensure that safe amounts of caffeine. The selective weight limit ensured that the highest possible dose received by an individual would be 270 mg of caffeine. The Harvard step test was utilized as a form of exercise to induce a state of aerobic respiration, and a BIOPAC system was utilized to capture measurements of reaction speed and grip strength. I will discuss the findings and implications of my experiment during my presentation.

COMPARISON OF ANTIBIOTIC RESISTANCE AND VIRULENCE GENES IN ESCHERICHIA COLI ISOLATED FROM STUDENT HEALTHCARE WORKERS AND STUDENT NON-HEALTHCARE WORKERS.

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Nosocomial (hospital acquired) infections are a growing problem, particularly because of the alarming increase antibiotic resistant organisms. For example, Escherichia coli (E. coli), the most common hospital acquired pathogen, have become increasingly resistant to commonly prescribed antibiotics. In particular, the incidence of extended-spectrum ♌-lactamase producing-E. coli (ESBL-E) resistant to most ♌-lactam antibiotics (penicillins and cephalosporins) infection is rising worldwide, including Lincoln area hospitals. In addition to its increasing antibiotic resistance, several virulence factors of E. coli play an important role in the bacteria's ability to cause disease. For the period from 2016 through 2017, rectal swabs taken as a part of two microbiology courses from students working in healthcare institutions yielded ESBL-Es from three students. However in the spring of 2018, cultures from nine pre-nursing students yielded ESBL-Es. The increase in the prevalence of ESBL-Es of this magnitude in pre-nursing students is alarming. In this study, we characterized and compared the drug-resistance and virulence genes of ESBL-E and non-ESBL-E isolated from students working in healthcare institutions with those outside the healthcare industry. For both E. coli types, the most prevalent virulence factors were siderophore iron-binding genes and adhesion genes. The main differences were seen in the beta-lactamase gene types. The five ESBL-E isolates contained the CTX-M beta-lactamase while the non-ESBL-Es contained either SHV or TEM-type beta-lactamases. Genetic analysis showed little relationship between the ESBL-E isolates.

INTEGRIN ALPHA 8 AND PROTOCADHERIN-15 KNOCKDOWNS IN OC-1 STEREOCILIA ASSOCIATED WITH USHER'S SYNDROME.

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Usher's syndrome is an autosomal recessive disorder characterized by hearing loss and degeneration of the retina. To date, there are eleven distinct genes associated with the development and progression of Usher's syndrome. Two of these genes, Protocadherin-15 and Integrin alpha 8 were knocked down in a mouse cell line. These cells were then grown on a plate, and tested using Western Blotting, % mRNA expression, and Immunofluorescent microscopy. These tests allowed for a quantitative as well as qualitative analysis of their gene expression within the mouse cell line. The results of this study will be used to further the understanding of Usher syndrome and allow for a more in-depth analysis of the function these two genes play in Usher's Syndrome.

BACTERIOPHAGE MS2 AS A SURROGATE MODEL FOR STUDYING NOROVIRUS.

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Norovirus, a highly contagious pathogen, is responsible for pandemic gastroenteritis outbreaks globally. Norovirus is often characterized as a virus capable of being viable on various surfaces for a long period of time. However, due to the inability to grow these viruses in cell culture, their study is problematic. An alternative to using the virus itself is to use a model organism or surrogate, like a bacteriophage, that is likely to respond in a similar way to environmental conditions or sanitizing treatments. In this study we used the Escherichia coli bacteriophage MS2 as a model to demonstrate how pathogens, like noroviruses, can be spread and persist on a variety of surfaces and hands. Like norovirus, MS2 is a naked single-stranded RNA virus. It infects E. coli by attaching to the sex pilus and causes a lytic infection. To test the viability of MS2 bacteriophage under a variety of conditions, the phage was inoculated onto steel, plastic, and wood surfaces and incubated at room temperature for 24 hr. In all cases, viable phage was recovered from each condition. Phage was inoculated onto the hand of a volunteer who then shook hands with a second volunteer. The process continued sequentially until 10 volunteers had completed the handshake test. Viable phage was recovered from all volunteers. Although MS2 is a norovirus surrogate, our data demonstrates just how communicable a pathogen like norovirus can be.

PRO-INFLAMMATORY EFFECTS AND CYTOTOXICITY OF ACETALDEHYDE AND MALONDIALDEHYDE.

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Cardiovascular disease is the leading cause of death worldwide, and many cardiovascular complications are attributed to the development of atherosclerotic lesions; resulting from chronic inflammatory and oxidative states. A major byproduct of lipid peroxidation, resulting from oxidative stress, is malondialdehyde (MDA) and acetaldehyde (AA). These covalently bind to cellular macromolecules, generating malondialdehyde-acetaldehyde adducts (MAA-adducts), which have been found in atherosclerotic lesions and are pro-inflammatory. Murine macrophage cells (J774) were cultured in the presence of high and low concentrations of MDA alone, AA alone, or AA + MDA for either 4- or 24-hours. Cells were then isolated and tested for the effects of pro-inflammatory cytokine regulation (IL-6, IL-1, and MCP-1) and cytotoxicity. Pro-inflammatory gene regulation was measured using RT-PCR, and cytotoxicity was measured using a cell counter to identify the percentage of viable cells post-treatment. The experiment showed upregulation of IL-1 in AA + MDA treated J774 cells for low concentration 4-hour (RQ=3.30), low concentration 24-hour (RQ=49.74), and high concentration 24-hour (RQ=45.54) treatments. There was significant IL-6 upregulation in 4-hour MDA alone low concentration (RQ=2.63), 4-hour low concentration AA + MDA (RQ=6.26), 4-hour high concentration AA + MDA (RQ=4.38); and in the 24-hour exposure of low concentration AA + MDA (RQ=4.63) and high concentration AA + MDA (RQ=4.29). There were no significant cytotoxic effects observed, nor significant MCP-1 upregulation in AA + MDA treated cells at either high or low concentrations. The results show the presence of both MAA-adduct precursors, AA and MDA, result in the upregulation of pro-inflammatory cytokines IL-1 and IL-6, but not MCP-1. There was differential gene expression of the pro-inflammatory cytokines because IL-1 was upregulated more than IL-6. Lastly, no cytotoxic effects of any treatments were observed.

TRADE-OFFS BETWEEN WINGSPAN AND LIFE HISTORY TRAITS IN BIRDS.

Karrie Sestak* and Gary Gerald, Nebraska Wesleyan University, Lincoln, NE

Life history theory predicts that life history trade-offs occur when finite energetic resources are invested in a particular trait denying those same resources from being allocated to different traits. In birds, trade-offs between life history traits, such as that between reproductive investment and survival, have been well documented and shown to play a crucial role in shaping life histories. Because flight is energetically expensive and varies with wing shape and size, lifetime energetic costs of flight could reduce energy available for life history traits. The objective of this study was to test the hypothesis that interspecific variation in wing length in birds will trade-off with either lifespan or reproductive output due to differences in energetic costs associated with different wing lengths. Life history traits (i.e. weight, wingspan, lifespan, and reproductive output) were recorded using online data bases and bird field guides on 841 different species in 12 orders and 13 Passeriformes families. Regression models and Pearson correlations were used to determine trade-offs among wingspan and life history traits among all birds and within orders, and Passerine families while correcting for body mass. We found a positive and negative relationships between wingspan and lifespan and reproductive output, respectively when examining all birds and those within the Passeriformes. The positive relationship between wingspan and lifespan represent an energetic trade-off between the cost of flight (increases with decreasing wingspan) and longevity.

NITROGEN FIXERS IN THE MAIZE RHIZOSPHERE AND ANALYSIS OF THEIR MBOA SENSITIVITY.

Frederick Azalekor*, Florian Wurtele, Martha Lopez-Guerrero, and Karin van Dijk, Department of Biochemistry, University of Nebraska at Lincoln, NE 68588

Nitrogen is an essential element for plant growth and development. However, plants cannot directly utilize atmospheric nitrogen in the N2 form. Only bacteria and archaea can reduce N2 to ammonia and nitrates which can then be absorbed by plants to make nitrogen-containing compounds such as amino acids. Our aim is to isolate nitrogen-fixing bacteria (NFB) that can promote the growth of corn. Our approach to finding nitrogen fixers associated with the corn rhizosphere was to grow corn in soil from the Nine-mile Prairie where *Trypsacum dactyloides*, a close relative of corn, grows without fertilizer.. We have isolated 34 bacteria able to grow in media without nitrogen by plating collected rhizosphere samples on minimal Burke's media lacking nitrogen. We are in the process of confirming that these rhizosphere bacteria have and express the nitrogen fixing genes by using PCR and RT-PCR to amplify the nifH gene. For the isolates to be potentially beneficial to corn, they must be able to grow in the presence of 2,4-dihydroxy-7-methoxy-1,4-benzoxazin-3-one DIMBOA), a corn root-exuded compound that acts as an antimicrobial. We are screening the isolates for their sensitivity to, ability to grow on, and chemotaxis to 6-methoxy-benzoxazolin-2-one (MBOA), a breakdown product of DIMBOA. Isolates with the best ability to grow and chemotaxis to MBOA will be used in greenhouse experiments to determine their impacts on maize growth.

PSEUDOMONAS AERUGINOSA PERSISTER CELL QUANTIFICATION USING A MICROFLUIDIC DEVICE.

Marco Perez, Doane University, Crete, NE.

Persister cells are dormant, non-dividing variants within bacterial communities that form randomly. Highly tolerant to antibiotics, they ensure the survival of a community when exposed to threatening stressors. After antibiotics are removed from their environment, persisters awaken and

have the ability to regrow biofilm populations. For this work, Pseudomonas aeruginosa strain PAO1 labeled with a green fluorescent protein (PAO1-GFP), was grown on tryptic soy and King A agar plates. King A agar was used to promote the production of pyocyanin, a quorum sensing molecule found to influence the population of persister cells. Biofilms of PAO1-GFP were grown in a high throughput microfluidic device called a BioFlux. This device serves as the platform to grow biofilms in small channels imaged by microscopy while media flows at constant shear force. To explore persister cell behavior Pseudomonas aeruginosa, biofilms where first grown to a monolayer level before a 29 hour antibiotic treatment. After the antibiotic was removed from the system, fresh media was flowed through the channels for an additional 45 hours of growth. In a separate experiment, suspended cells were treated with the antibiotic treatment prior to plating on the BioFlux and allowed to grow. In both experiments, surface coverage and biofilm accumulation were used to compare the persister cell growth and persister cell populations between TSA and King A grown cultures.

COMPARISON OF GROWTH RATES OF SUSPENDED AND BIOFILM CELLS OF PROTEUS MIRABILIS GROWN IN TSB.

Michael Wieduwilt*[1] and Christopher D. Wentworth[2], Doane University, Crete, NE 68333, [1]Department of Biology, [2]Department of Physics & Engineering

Proteus mirabilis is a species of bacteria known to pose health hazards in people requiring urinary tract catheters when bacterial biofilms colonize the catheter surface. Understanding the growth kinetics of Proteus mirabilis will provide information that can be helpful in developing antifouling technologies. In this investigation, the growth rates of suspended cells in TSB media is measured at 37 [°C]. The growth rate of biofilm cells in TSB media is measured at 37 [°C] and a shear stress value of 0.297 [dyne/cm^2] produced by fluid flow in the bioreactor.

FOURIER ANALYSIS OF MICROSCOPIC IMAGES OF PSEUDOMONAS AERUGINOSA BIOFILMS GROWN UNDER CHANGING SHEAR STRESS CONDITIONS.

Sarah Vaughn* and Christopher D. Wentworth, Department of Physics & Engineering, Doane University, Crete, NE 68333

The development of biofilm morphology involves a complex interplay of biological, chemical, and physical conditions and processes that operate at various time scales. Untangling the effect of these properties on morphological development is challenging. Previous experimental work has focused on morphological properties such as surface coverage, surface roughness, textural entropy, biovolume, and interfacial area. In this investigation, we explore uncovering more subtle structural patterns in microscopic images through the use of Fourier transforms. The images were obtained on P. aeruginosa biofilms using a microfluidics device that can maintain a constant shear stress of the fluid media across the film, coupled with fluorescent microscopy to obtain images as a function of time. Preliminary results are presented of the Fourier analysis of images as a function of time taken at different shear stress values.

BREEDING BLUEBIRDS AND INVASIVE ANTS: INFLUENCE OF RESOURCE COMPETITION OR PREDATION ON NESTLING SEX RATIOS.

Andrew Herley*, Lauren M. Gillespie*, Department of Academic Education, Central Community College, Columbus, NE, 68602, Paige Reimers, University of Nebraska-Lincoln, Lincoln, NE 68588, Lynn Siefferman, Dept. of Biology, Appalachian State University, Boone, NC 28608

Eastern bluebirds breeding in a southern Alabama population skew the sex ratios of their nestlings in concert with density of invasive fire ants. Birds in this population produce more female

offspring when ant density is higher as both fire ants and bluebirds are terrestrial insectivores and compete for food resources. This was then investigated at two sites in a southern Mississippi population of bluebirds from 2013-2015. Ant density was surveyed between nestling days 6-13, and average ant density nor total ants collected appeared to influence sex ratios or hatch success. One site was found to be home to invasive argentine ants, and, at this site in 2015 alone, there was a trend toward female-biased broods with higher argentine ant density only. Anecdotally, at this site argentine ants were also a significant nest predator. Results should be taken lightly as sample sizes are small, and results may represent influences of selection pressures related to predation and not resource competition. Methods will be replicated in Platte County, Nebraska in the upcoming 2019 field season for Nebraskan-Mississippi population comparisons.

DESCRIPTION OF POSSIBLE HYBRID BARN X CLIFF SWALLOWS IN EAST CENTRAL NEBRASKA IDENTIFIED VIA ANOMALOUS PLUMAGE VARIATION.

Kayla Kreizel*, Elizabeth Ewing, Alejandro Espino, Jenessa Grooms, Alex Koch, Steve Heinisch, Lauren Gillespie*, Department of Academic Education, Central Community College, Columbus Nebraska, 68602.

Research proposed here documents 12 individuals that appear to be possible hybrid barn (Hirundo rustica) X cliff swallows (Petrochelidon pyrrhonota) nesting under a bridge. Birds were caught passively as by-catch in mist-nets (September 2018) in East-Central Nebraska during a routine banding demonstration for general biology labs. Upon attempting to identify the species, we noticed facial and breast plumage amongst individuals observed varied significantly from those in identification guides. There were differences in streamer length and asymmetry as well as size and color variation in tail spots. Two types of nests are present: typical, open-cup barn swallow nests and colonially-grouped, tube-shaped nests typical of cliff swallows. Behavioral observations revealed the birds were utilizing both nest-types. When students played cliff swallow calls, birds responded territorially by calling, swooping, and diving at the source of the sound. When birds return from spring migration to breed, they will be captured and blood sampled for both hormones and genetic testing and plumage samples will be taken. Streamers and facial plumage variation will be measured, photographed, and quantified. Courtship and nest building behavior and audio data will be collected from birds to ascertain the basis of the plumage abnormality. An alternative hypothesis to species hybridization is environmental contamination (the breeding population is located above an agricultural drainage creek); facial plumage abnormalities and those of streamer/spot asymmetry are consistent with documented genetic and plumage anomalies in barn swallow populations exposed to environmental radiation in Chernobyl.

ANALYSIS OF RNAseq DATA REVEALS MEDIA STATE DEPENDENT TRANSCRIPT PROFILE IN CANDIDA ALBICANS.

Patricia Harte-Maxwell, Department of Biology, University of Nebraska at Omaha, NE 68182

In a large portion of the population, Candida albicans is a harmless member of the gut microbiome; however, this opportunistic fungal pathogen is the leading cause of candidiasis infections. The pathogenesis of C. albicans' relies on alternating yeast and hyphal states via the process of filamentation, and characteristics of filamentation are major qualifications when clinically assessing the severity of infection. In a research setting, media type and state impact the filamentation of C. albicans, leading to observed phenotypes which do not necessarily reflect *in vivo* traits. To examine the effect various media have on filamentation a time course analysis of C. albicans strain SC5314 was performed. Cells from an overnight sample were plated on one of the following media: YPD, Lee's, Spider, FBS, and RPMI, and grown at intervals 30, 60, 90, and 120 minutes at 30°C or 37°C. Plates were imaged

before cells were collected for RNA extraction. Evaluations of transcript levels at later stages of filamentation have been poor predictors of genes involved in filamentation; therefore, it was decided that RNA would be extracted from cells collected at 30 minutes post induction, a time point that precedes the development of filaments in inducing conditions based on imaging. RNAseq data has been analyzed to reveal the activity of genes at the initiation of filamentation.

DAY TO DAY AND LEG TO LEG VARIATION IN SKELETAL MUSCLE GENE EXPRESSION.

Zohal Alizai, University of Nebraska-Omaha, Omaha, NE.

BACKGROUND: Skeletal muscle biopsies are extensively used in research to determine the effects of exercise. Usually, sequential biopsies are taken before and after exercise in order to determine the influence of exercise on gene expression. Often it is not clear if the results are due to exercise or as a result of damage cause by the biopsy to the muscle. Previous studies have proven that multiple biopsies in the same leg cause stress to the muscle and such stress leads to inflammation and other response pathways that alter the gene expression. PURPOSE: 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. METHODS: Eight participants had a muscle biopsy taken from the vastus lateralis muscle on three separate occasions approximately 1 week apart after repeating the same diet and exercise for 24 hours prior. Legs were randomized and altered on subsequent weeks. Genes related to mitochondrial development and stable reference were measured using real-time PCR. The first biopsy was defined as stable reference control condition and gene expression was normalized using 2-ΔΔCT and 2-ΔCT method. Results: No difference was found in gene expression from day to day variation or between legs for ERRa ($p = 0.85$), GABPA ($P = 0.85$), MEF2a ($P = 0.86$), NRF1 ($P = 0.97$), PPARG ($P = 0.38$), PGC1a ($p = 0.88$), SIRT1 ($p = 0.299$), TFAM ($p = 0.99$), and VEGF ($p = 0.61$). For FNDC5 there was a difference between legs, trial 1 compared to trial 2 ($p = 0.04$), but trial 2 compared to trial 3 did not show a difference ($p = 0.906$) and not within the same leg trial 1 to trial 3 ($p = 0.946$). The reference genes B2M ($p = 0.005$) and CYC ($p = 0.002$) were different between biopsies; GAPDH and RPS18 were not different between biopsies ($p > 0.05$). Conclusion: While many genes are statistically not different between legs and between days, researchers need to determine the amount of error that is acceptable in each study design.

ESTROGEN POSITIVELY AFFECTS SPATIAL DISCRIMINATION IN ADULT FEMALE OVARIECTOMIZED RATS.

Raissa Souza*[1,2], Sejal Chudasama[2], Justin Garrel[2], Henry Blair[2], and Jana Veliskova[2], [1]Biology Department, Nebraska Wesleyan University, NE 68504. Dept of Cell Biology, [2]New York Medical College, NY 10595

The dentate gyrus is a part of the hippocampus involved in pattern separation processing. In the hippocampus, there are dendritic spines, which are sites of synaptic plasticity that increase the surface area of neurotransmission and allow the brain to collect new information. Learning and memory are related to a type of synaptic plasticity called long term potentiation (LTP) which means a stronger communication of neurons means better learning. Estrogen modulates hippocampal function. β-Estradiol plays a role in the dentate gyrus learning process by: regulating spine density, modulating acetylcholine expression, modulating gating function of the dentate gyrus by selective filtering the frequencies, regulating NMDA-mediated responses, and vitro slices data show that estrogen affects expression in the dentate gyrus suggesting differences in the dentate gyrus function. It is hypothesized that the pattern separation detection depends on the hormonal status. Adult ovariectomized females

were used on the experiment. Four to six days after the surgery, animals were assigned to their groups and either injected with 2mg/0.1ml/day of estrogen or 0.1ml of oil for 4 days. The animals underwent behavioral spatial environmental test and metric test. It was hypothesized oil-injected animals would have deficit on separation detection tasks compared to estrogen treated animals. However, this study rejects the hypothesis as oil injected groups significantly reared and explored the objects more on the environmental test and had significantly explored more on the metric test, while estrogen treated animals showed deficits in exploration of the new environment as well as the new position of the objects. Experiment showed performance on a spatial task was impaired by ovarian steroids. This suggests the new information in these tasks may come in frequencies, which are filtered by the dentate gyrus. Future directions include testing animals at the water maze and have animals to be trained and receive an estrogen replacement therapy for a longer period of time.

DEFINING NEUROLOGICAL DISABILITY IN SJÖGREN-LARSSON SYNDROME AND THE SEARCH FOR A BIOMARKER.

William B. Rizzo and Morgan L. Zabel*, Department of Pediatrics, University of Nebraska Medical Center, 42nd and Emile St., Omaha, NE 68198 and the Department of Biology, Nebraska Wesleyan University, 5000 St. Paul Ave, Lincoln, NE 68504.

Sjögren-Larsson syndrome (SLS) is a rare autosomal recessive neuro-ichthyotic disorder caused by mutations in the ALDH3A2 gene encoding fatty aldehyde dehydrogenase (FALDH), which catalyzes the oxidation of fatty aldehydes to fatty acids. Associated clinical features include congenital ichthyosis, spastic diplegia, a distinctive retinal maculopathy, and developmental delay/intellectual disability [15]. While the first detectable sign of SLS is the presence of ichthyosis at birth, the neurological symptoms (spasticity, intellectual disability) do not develop until later in the first two years of life [5]. The relationship between these clinical symptoms has never been assessed before. We therefore conducted a cross-sectional study to define the correlation between different neurological clinical features in SLS: Intelligence Quotient (IQ), spasticity, and functional abilities. We also sought out to find a biomarker in the erythrocytes for the disease.

ACTIVITY OF METABOLIC ENZYMES IN SERPENTINE SKELETAL MUSCLE RESULTING FROM DIFFERENT METHODS OF LIMBLESS LOCOMOTION.

Paul Wurtz, Department of Biology, Nebraska Wesleyan University, Lincoln, NE, 68504

Locomotor performance is important to evolutionary fitness in many animals because of the role it plays in avoiding predators, finding food, locating mates, social behaviors, and finding and using suitable habitats. To examine how selection can influence the variation in whole-animal functional performance traits, one must understand the linkage among genetic, biochemical, and physiological mechanisms to differences in locomotor performance. An excellent model organism that can be used to examine these questions is snakes. Being limbless, snakes have the capacity to move in a variety of different ways depending on the microhabitat they are moving through. Corn snakes (Pantherophis guttatus) will be acquired and divided into four different locomotor treatment groups (terrestrial lateral undulation, concertina, arboreal, and no movement). We hypothesized that modes of locomotion that require quicker bursts of speed will use anaerobic metabolic pathways and less explosive movement would use aerobic pathways. Lactate dehydrogenase results were inconclusive. Citrate synthase, cytochrome c oxidase, and pyruvate dehydrogenase activities were measured successfully, but the results did not match the hypothesis that there is plasticity in muscle enzyme regulation appeared to be a difference between moving and nonmoving there was no difference between the individual moving groups. Future research should investigate the idea of a summation of all muscles in the body.

SKELETAL MUSCLE MITOCHONDRIAL BIOGENESIS IN RESPONSE TO EXERCISE AND COLD EXPOSURE.

Camille Larson*, Megan Vande Hei, and Dustin Slivka, Department of Health and Kinesiology, University of Nebraska at Omaha, NE 68182

BACKGROUND: Aerobic exercise triggers mitochondrial biogenesis, the generation of new mitochondria, by ATP depletion and subsequent activation of the AMPK signaling pathway. This leads to enhanced expression of PGC-1α, a positive regulator of respiration, mitochondrial biogenesis, and adaptive thermogenesis. Previous research from our lab has shown that exercise followed by cold recovery enhances the transcription of genes associated with mitochondrial growth and division, however the recovery period was necessary for this response. Perhaps exercising in a colder external environment would induce a greater thermoregulatory response and gradient between ambient skin and core temperature that may lead to altered mitochondrial turnover. These data may help exercise-induced mitochondrial biogenesis response and thus aid in the development of temperature-optimized training protocols to combat mitochondrial dysfunction. PURPOSE: To examine the mRNA expression of PGC-1α and other select genes related to mitochondrial biogenesis after exercise in a cold environmental temperature compared to exercise in room temperature. METHODS: Eleven recreationally trained males cycled at 65% Wpeak for an hour at -6°C and 20°C in a random, counterbalanced order. A muscle biopsy was taken from the vastus lateralis pre-exercise as well as 3-h and 6-h post-exercise for analysis of genes associated with mitochondrial biogenesis (PPGC-1α, GABPA, ERRα, NRF1, TFAM, and VEGF). RESULTS: VEGF and PGC-1α increased with exercise, but the response of PGC-1α was higher in the cold ($p < 0.05$). NRF1 was lower after cycling regardless of temperature ($p = 0.001$). ERRα decreased at room temperature but increased 6h-post-exercise in the cold ($p < 0.05$). GABPA followed the same pattern ($p = .106$). TFAM was unaltered at room temperature but increased between 3-h and 6-h post-exercise in the cold ($p = 0.008$). CONCLUSION: These data indicate that PGC-1α, ERRα, and TFAM are affected by environmental temperature during exercise with a more favorable response in the cold.

IMPACTS OF EXERCISE AND ENVIRONMENTAL TEMPERATURE ON MITOCHONDRIAL QUANTITY AND QUALITY.

Halee Keller*, Robert Shute, Dustin Slivka, University of Nebraska-Omaha, Omaha, NE

BACKGROUND: Mitochondria are highly concentrated in skeletal muscle tissue, and undergo damage from ROS during metabolic processes. This damage is often left unrepaired and leads to mitochondrial dysfunction, which has been linked to many common diseases. Exercise training increases mitochondrial development within skeletal muscle tissue and thus may be protective. Environmental temperature, when paired with exercise may provide an even greater effect than exercise alone. PURPOSE: The purpose of this study is to analyze the effects of three weeks of exercise training with various environmental temperature conditions on mitochondrial quantity and quality. METHODS: Thirty-six male subjects performed one hour of cycling five days/week for three weeks in either a hot (33° C), cold (7° C), or neutral (20° C) condition. Biopsies were taken from the vastus lateralis muscle for analysis of mitochondrial quantity and quality on the first and last day of training (pre, post, and 4-hrs post exercise). Using PCR analysis to analyze our target regions, mtMinArc, mtMajArc, and B2M, we can calculate mtDNA copy number and deletion ratio. RESULTS: mtMinArc and mtMajArc copy number did not change within any temperature condition before or after 3 weeks training ($p>0.05$). mtDNA deletion ratio was lower in the cold compared to both hot ($p<0.001$) and neutral ($p=0.006$) both before and after 3 weeks training. CONCLUSIONS: These data indicate that the adaptive effects of exercise in three weeks do not cause a change in mitochondrial quantity. However, in cold conditions the lower mtDNA deletion ratio implies mitochondrial remodeling, which results in higher mitochondrial quality.

SESSION A

TRACKING UV-INDUCED CANCER DEVELOPMENT USING A MULTI-PHOTON PHASOR FLUORESCENCE LIFETIME IMAGING MICROSCOPY SETUP.

Kelsey A. Jackson*, Marifel F. Gabriel, Dominick M. Myers, Molly Myers, Katie D. Sotelo, Laura Hansen, Michael Nichols, Department of Physics, Creighton University, NE 68178.

The rapid growth and division caused by cancer development results in metabolic activity distinct from that of healthy cells. Using fluorescent lifetime imaging microscopy (FLIM), the lab has developed a clinically relevant technique to non-invasively detect these differences. This multi-photon method allows a low energy, near-infrared laser to excite endogenous NAD(P)H, a major metabolic indicator, without requiring carcinogenic higher energy photons. The microscope developed in the lab was built more cheaply than a comparable commercial microscope while still making multi-photon Phasor FLIM analysis of *in vivo* cells possible. Our current research uses this optical setup to track metabolic and morphological changes in live SKH-1 mice both as a response to chronic UVA exposure and upon the development of cancerous tumors on the skin. Preliminary results indicate a higher phasor index in UV exposed skin and a yet higher phasor index in skin diagnosed as tumorous. This technique shows promise as a sensitive, less expensive diagnostic tool for early-stage skin cancer detection. This study was made possible by grants from the National Institute of 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.

MULTI-PHOTON FLUORESCENCE LIFETIME IMAGING MICROSCOPY OF NAD(P)H PHASOR ANALYSIS CHARACTERIZES THE METABOLIC CHANGES IN CHRONIC UVA EXPOSED SKH-1 MICE.

Marifel F. Gabriel*, Kelsey A. Jackson, Dominick M. Myers, Molly S. Myers, Katie D. Sotelo, Lindle D. Che, Laura Hansen, Michael G. Nichols, Department of Physics, Creighton University, NE 68178.

Cancer cells are known for their distinct altered metabolic activity because of the high energy demand needed for cell growth and division. Multi-photon fluorescence lifetime imaging microscopy (FLIM) makes use of endogenous NAD(P)H as a fluorescent indicator to non-invasively monitor altered metabolic activity of cancer cells. This technique utilizes two near-infrared photons to excite NAD(P)H rather than a single UV photon more likely to damage biological tissues. The study makes use of this technique to monitor metabolic and morphological activity within chronic UVA exposed SKH-1 mice epidermal cells and non-UVA exposed SKH-1 mice epidermal cells (sham) over a period of 25 weeks. UVA exposed SKH-1 mice received a daily dose of 15 kJ/m^2 of UVA, and each treatment group was characterized by their NAD(P)H phasor FLIM analysis. As the study progressed, tumor formations due to chronic exposure of UVA were also imaged, analyzed, and compared to the sham. Chronic UVA exposed SKH-1 mice showed higher phasor indices early on in comparison to non-exposed live SKH-1 mice epidermal cells. Tumor images produced another distinct phasor distribution that also had higher phasor indices. Throughout the study, distinctions were being made between the sham and UV exposed mice that shows promise of finding the mechanism to define the difference between the two groups. Furthermore, this study explores a potential for a non-invasive, sensitive approach to diagnose early-stage skin cancer development

IDENTIFYING THE BINDING LOCATION OF ATRAZINE AND ITS METABOLITES ON HSA USING HIGH PERFORMANCE AFFINITY CHROMATOGRAPHY.

Kati Frankenberg* and Annette C. Moser, Department of Chemistry, University of Nebraska at Kearney, NE 68849.

Human Serum Albumin (HSA), the most abundant transport protein in blood, 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 three 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. Separate competitive binding studies for all four compounds with L-tryptophan showed no competition at Sudlow Site II. Results from an additional study with desethylatrazine will also be presented.

INTRODUCTION TO EPICS-BASED CONTROLS FOR THE STAR EXPERIMENT AT BROOKHAVEN NATIONAL LABORATORY.

Raelynn McCreary, Creighton University, Omaha, NE 68178.

In this presentation, I will explain my contribution to Creighton's work with the Solenoidal Tracker At RHIC, or STAR, through use of the Experimental Physics and Industrial Controls System, or EPICS, software. RHIC is an acronym that refers to the Relativistic Heavy Ion Collider at the Brookhaven National Laboratory in Long Island, New York. The STAR controls system is used to control and monitor parameters, such as temperature, for the STAR detector. I will also describe functions of STAR as well as the functions of the controls system.

FEASIBILITY OF MEASURING THE Φ MESON PHOTOPRODUCTION IN ULTRA-PERIPHERAL COLLISIONS AT STAR.

Ethan Wahle, Creighton University, Omaha, NE 68178.

At Brookhaven National Laboratory's Relativistic Heavy Ion Collider, the STAR collaboration has studied gold + gold ultra-peripheral collisions, in which the ions come close enough to interact electromagnetically without physically colliding with one another. These interactions can create a Φ Meson that decays into a pair of Kaon Mesons (K+ and K-) that we can potentially detect. Although other vector mesons have been studied at the Relativistic Heavy Ion Collider, the Φ Meson has not yet been measured. Ultra-peripheral collisions can involve coherent interactions with the entire nucleus or incoherent interactions with individual protons. Coherent collisions occur more frequently but incoherent collisions produce Φ Mesons with much greater momenta, that are therefore easier to detect. This study discusses the feasibility of detecting the Φ Mesons daughter particles from both coherent and incoherent production mechanisms.

USING AMINO ACIDS IN THE FIGHT AGAINST ANTIBIOTIC RESISTANCE.

Caitie Lemmons*, Jonah Scheffler, and David Peitz, Chemistry, Wayne State College, 1111 Main St., Wayne, NE.

Histidine is an important amino acid in the synthesis of proteins and bacteria may forgo the resistance mechanism when introduced to an antibiotic bonded to histidine. Histidine was bonded to doxycycline through esterification by first forming the acid chloride of histidine using SOCl2 and benzotriazole in DCM. After the acid chloride is formed, doxycycline is added to form the product ester. In a similar fashion, histidine was bonded to ciprofloxacin by forming the acid chloride of ciprofloxacin

and reacting it with histidine. The reactions were followed using TLC and FTIR. The resulting crude products were tested against resistant Salmonella to determine their effectiveness.

UPGRADES TO SAFETY SYSTEM SOFTWARE FOR THE STAR EXPERIMENT SLOW CONTROLS AT BROOKHAVEN NATIONAL LABORATORY.

Joey D'Alesio and Sam Ruiz, Creighton University, Omaha, NE 68178.

The STAR collaboration uses a detector, the Solenoidal Tracker At RHIC (the Relativistic Heavy Ion Collider), which is located at Brookhaven National Laboratory. RHIC collides nuclei at relativistic speeds to artificially create conditions similar to the initial conditions of the universe. Due to high levels of radiation produced while RHIC is running, all of the systems must be remotely controlled. Thus, detector controls are a vital part of the experiment. The STAR detector control system was designed and implemented in the 1990s by faculty and students from Creighton University. The goal of this project is to design and implement control software to monitor the safety systems at STAR using the new readout system. These software upgrades are imperative for future expandability as the existing Safety Interlock Readout System is hard to upgrade. The new system that we will work on this summer will be able to handle the new safety signal inputs in case a change to the Safety Interlock System occurs. A new electronic board that replicates the signals from the safety interlock system to both the existing readout system and the new readout system has been developed. The signals will be replicated to both systems, which will run in parallel for a year, to confirm that the new readout system can run without problems. In our talk, we will discuss the Interlock Safety System and the software upgrades we will be performing this summer.

NANOPARTICAL PALLADIUM HYDROGENATION CATALYSIS OF ALKYNES. THE VINYL REVERSAL AND HORIUTI-POLANYI MECHANISMS.

Mackenzie Enmeier*, Kara Grossman, Grace Recker, Katie Cunningham, and Bruce Mattson, Department of Chemistry, Creighton University, Omaha, NE 68178.

Alkynes are hydrogenated to alkenes and alkanes in the presence of an alumina supported nanoparticle palladium catalyst (0.5%). Studies involving the hydrogenation and deuteration of 1-butyne are presented in the context of the accepted mechanisms for these reactions.

NOTES

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Mid Plains Community College, North Platte	Dr. Aaron McLean
Nebraska Wesleyan University, Lincoln	Dr. Therese McGinn
Northeast Community College, Norfolk	Ms. Angie Jackson
Peru State College, Peru	Dr. Richard Clopton
Southeast Community College, Lincoln	Mr. Dan Fogell
Union College, Lincoln	Dr. Christina Burden
University of Nebraska at Kearney	Dr. Nathaniel Bickford
University of Nebraska–Lincoln	Dr. Stephan Ducharme
University of Nebraska at Omaha	Dr. Paul Davis
University of Nebraska Medical Center, Omaha/Lincoln	Dr. Ken Bayles
Wayne State College	Dr. Gustavo Zardeneta
Western Nebraska Community College, Scottsbluff	Mr. Loren King
York College	Mrs. Gail Miller

FRIENDS OF THE ACADEMY

The Academy has several endowments courtesy of Benjamin and Rachael Corr Maiben (1959), and C. Bertrand and Marian Othmer Schultz (1992).

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

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

INDIVIDUALS

James Carroll, Omaha
James Wood, Omaha
Francis & Dorothy Haskins, Lincoln
Stan Kubicek, Lincoln

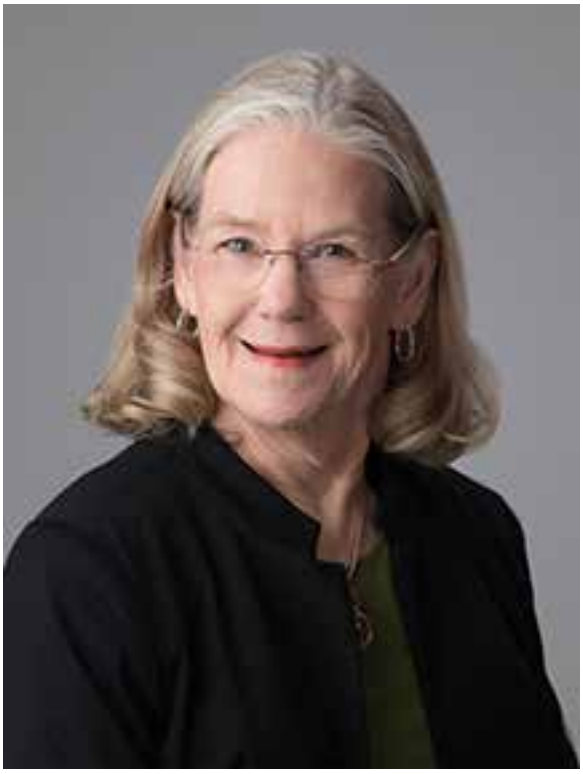
ORGANIZATIONS

Lincoln Community Foundation, Lincoln
Nebraska Space Grant Consortium, Omaha
Buffalo County Visitor Promotion Committee

NEBRASKA ACADEMY OF SCIENCS
FRIEND OF SCIENCE AWARD WINNERS

YEAR	WINNER
2018	Mary Kalen Romjue, Florida
2018	Michael Sibbernsen, Lincoln
2017	Kacie Baum, Omaha
2017	Todd Young, Wayne
2016	Randall Lienemann, Hildreth
2016	James Turpen, Omaha
2015	David Dow, Omaha
2015	Jim Woodland, Omaha
2014	Dan Sullivan, Omaha
2014	Michael Voorhies, Lincoln
2013	James Carr, Lincoln
2013	Aurietha Hoesing, Omaha
2012	Maurice Godfrey, Omaha
2012	Mary H. Pritchard, Lincoln
2011	Elizabeth Mulkerrin, Omaha
2011	William Wehrbein, Lincoln
2010	John Rosenow, Lincoln
2010	Nancy Rosenow, Lincoln
2009	Lois Mayo, Lincoln
2009	Carol Wipf, Lincoln
2008	Dave Goss, Lincoln
2008	Susan Seacrest, Lincoln
2007	Mary Ettel, Wayne
2007	Robert Reeder, Lincoln
2006	Ed Brogie, Wayne
2006	Judy Williams, Central City
2005	Charles Lang, Uehling
2005	Kathleen Jacobitz, Pawnee City
2004	Charles Holliday, Omaha
2003	Ms. Tranda Fischelis, Philadelphia, PA
2002	Robert and Martha Kaul, Lincoln
2001	Henry Baumgarten, Lincoln
2001	Claire Oswald, Omaha
2000	David T. Lewis, Lincoln
1999	Albert W. Zechman, Lincoln
1998	Robert B. Nelson, Lincoln
1997	Francis A. Haskins, Lincoln
1997	Robert B. Johnston, Lincoln
1997	M. Rosalind Morris, Lincoln
1996	Mylan T. & Eunice Earhart Stout, Lincoln
1995	C. Bertrand Schultz, Lincoln – A farewell, rather than award
1993	Robert Crosby, Lincoln
1993	Virginia Smith, Chappell
1992	Florence Boring Lueninghoener, Fremont
1989	Robert W. Allington, Lincoln
1984	Lewis E. Harris, Lincoln
1981	Mr. & Mrs. Thomas C. Woods, Jr., Lincoln
1980	George & Olivia Lincoln, Lincoln
1977	Vance D. Rogers, Lincoln
1976	Walter D. Behlen, Columbus
1970	Mabel L. Criss, Omaha

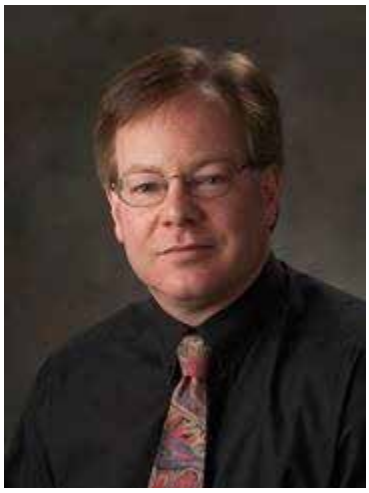
FRIEND OF SCIENCE AWARD TO JULIE THOMAS



Julie Thomas currently serves as the Interim Dean for Research in the College of Education and Human Sciences at the University of Nebraska-Lincoln. Beginning with her elementary teaching experiences in rural and urban Nebraska classrooms (14 years), Thomas recognized children's science enthusiasm and decided to pursue a doctoral degree in science education. Now, as a university professor (24 years), Thomas enjoys research and teaching related to elementary science education. She has led numerous funded projects and published research focused on children's science learning and teacher professional development. Proud accomplishments include collaborative efforts – such as No Duck Left Behind, a partnership with waterfowl biologists to promote wetland education efforts, and Engineering is Everywhere (E2), a partnership with a materials engineer to develop a time-efficient model for STEM career education.

Throughout her teaching career, Thomas has been actively involved in national and international professional associations such as the School Science and Mathematics Association (SSMA-Past Executive Director), National Science Teachers' Association (NSTA-Awards and Nominations Committees), the Council for Elementary Children International (CESI-Past President). In Nebraska, Thomas has been a long-time member of the Nebraska Association of Science Teachers (NATS) having served on the board from 1991-92 and continuing as a NATS conference presenter. Thomas continues her science education leadership as the NJAS Director of the Southeast Regional Science Fair.

FRIEND OF SCIENCE AWARD TO KEVIN LEE



Kevin Lee is a Research Associate Professor at the University of Nebraska-Lincoln (UNL). His appointment is shared by an academic department where his duties focus on instruction and an educational center where he works on curriculum development, outreach, teacher training, and technology support.

He oversees the Astronomy Education at the University of Nebraska web site at http://astro.unl.edu which houses computer simulations, a library of dynamic peer instruction questions, a suite of interactive ranking and sorting tasks, and a growing library of astronomy demonstration videos available on YouTube. The simulations have been used globally by astronomy faculty for more than 10 years. This work was largely responsible for Kevin winning the AAPT's Halliday and Resnick Award for Excellence in Undergraduate Physics Teaching in 2012.

Kevin has organized an annual workshop in astronomy education each fall for over 15 years. This workshop has been held jointly with the fall meeting of the Nebraska Chapter of the American Association of Physics Teachers. He recently has returned to UNL after a three-year stint as a rotating program officer in the National Science Foundation's Division of Undergraduate Education.

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