2014

Proceedings of the 126th Annual Meeting of the Iowa Academy of Science [Program, 2014]

Iowa Academy of Science

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PROCEEDINGS OF THE 126TH
ANNUAL MEETING
OF THE
IOWA ACADEMY OF SCIENCE

IOWA CENTRAL
COMMUNITY COLLEGE

April 11 & 12, 2014
Fort Dodge, Iowa
## FRIDAY SCHEDULE

Room assignments are included with event descriptions inside

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<td>IJAS Registration</td>
<td>BHS Entrance</td>
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<tr>
<td>7:30—4:30</td>
<td>IAS Bookstore Open</td>
<td>BHS 111</td>
<td>2, 9</td>
</tr>
<tr>
<td>8:00</td>
<td>Registration Desk Opens</td>
<td>BHS Entrance</td>
<td>3</td>
</tr>
<tr>
<td>8:00</td>
<td>Silent Auction begins</td>
<td>BHS Entrance</td>
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<tr>
<td>8:00-10:30</td>
<td>Morning Snack</td>
<td>BHS Rotunda</td>
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<tr>
<td>8:00-10:45</td>
<td>IJAS Competition Posters</td>
<td>CEB All Purpose Room</td>
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<td>8:00-10:45</td>
<td>IJAS Competition Presentations</td>
<td>BHS 107, 115, 116, 202, 203, 207,209, 210</td>
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<td>11:00-Noon</td>
<td>General Session I</td>
<td>BHS 105: Auditorium</td>
<td>7</td>
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<tr>
<td>Noon-1:15</td>
<td>IJAS Award Luncheon</td>
<td>CEB All Purpose Room</td>
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</tr>
<tr>
<td>1:30-2:15</td>
<td>IAS Business Meeting</td>
<td>AST 107</td>
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<td>1:30-3:30</td>
<td>Iowa DOE Science Meeting</td>
<td>AST 004</td>
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<tr>
<td>2:30—3:30</td>
<td>Student Programs Committee</td>
<td>BHS 210</td>
<td></td>
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<td>2:30-4:30</td>
<td>Symposiums A, B, C</td>
<td>BHS 105, AST 107, AST 101/103</td>
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<td>U of Iowa Mobile Museum</td>
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<tr>
<td>4:30—5:45</td>
<td>Senior Poster Session</td>
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<tr>
<td>4:45-6:00</td>
<td>Social Hour</td>
<td>CEB Hallway/All Purpose</td>
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<tr>
<td>6:00-7:30</td>
<td>President’s Banquet</td>
<td>CEB All Purpose Room</td>
<td>20, 21</td>
</tr>
<tr>
<td>7:45-8:45</td>
<td>General Session II</td>
<td>BHS 105: Auditorium</td>
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Book Store: Friday 7:30—4:30; Saturday 8:00—3:30; BHS 111
Silent Auction: Friday; Saturday Morning, BHS Entrance; Pick up items Saturday 1:00—3:00

AST: Applied Science & Technology Building  
CEB: Career Education Building  
BHS: Bioscience & Health Science Building  
See campus map inside the back cover.
# SATURDAY SCHEDULE

Room assignments are included with event descriptions inside

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</thead>
<tbody>
<tr>
<td>8:00</td>
<td>Registration Desk Opens</td>
<td>BHS Entrance</td>
<td>3</td>
</tr>
<tr>
<td>8:00—3:30</td>
<td>IAS Bookstore Open</td>
<td>BHS 111</td>
<td>2, 9</td>
</tr>
<tr>
<td>8:00—1:30</td>
<td>U of Iowa Mobile Museum</td>
<td>Parking Lot SE of BHS Building</td>
<td>9</td>
</tr>
<tr>
<td>8:00-10:30</td>
<td>Morning Snack</td>
<td>BHS Rotunda</td>
<td></td>
</tr>
<tr>
<td>8:20-10:45</td>
<td>Section Meetings</td>
<td>BHS and AST</td>
<td>26—31</td>
</tr>
<tr>
<td>11:00-Noon</td>
<td>General Session III</td>
<td>BHS 105: Auditorium</td>
<td>23</td>
</tr>
<tr>
<td>11:45</td>
<td>IJAS Silent Auction Bidding Closes</td>
<td>BHS Entrance</td>
<td>3</td>
</tr>
<tr>
<td>Noon-1:15</td>
<td>ESTA Award Luncheon</td>
<td></td>
<td>24</td>
</tr>
<tr>
<td>1:00-3:00</td>
<td>Pick up IJAS Auction Items</td>
<td>Registration Desk - BHS</td>
<td>3</td>
</tr>
<tr>
<td>1:20-2:20</td>
<td>IJAS—Investigating Science at ICCC</td>
<td>BHS Building</td>
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</tr>
<tr>
<td>1:15-5:00</td>
<td>Section Meetings Continue</td>
<td>BHS and AST</td>
<td>26—31</td>
</tr>
<tr>
<td>1:30</td>
<td>Geological Society of Iowa Field Trip</td>
<td>BHS Parking Lot</td>
<td>25</td>
</tr>
<tr>
<td>3:30</td>
<td>Registration Desk Closes</td>
<td>BHS Entrance</td>
<td>3</td>
</tr>
</tbody>
</table>

## Registration Desk Hours

Friday—7:30 a.m., Registration opens for IJAS; Friday — 8:00 a.m. to Noon and 1:15 p.m. to 5:00 p.m. for all attendees.
Saturday — 8:00 a.m. to Noon and 1:00 p.m.-4:00 p.m.

* Iowa Central Community College, April 11 & 12, 2014  
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Iowa Academy of Science
Board of Directors

Gale Vermeulen, President
Nadine Weirather, President Elect
Thomas Ervin, Past President

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Kavita Dhanwada (2014)
Chad Heinzel (2015)
Mahdi Al-Kaisi (2015)
Johanna Foster (2016)
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Iowa Academy of Science

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The Iowa Academy of Science
is established to further scientific research
and its dissemination, education in the
science, public understanding of science,
and recognition of excellence
in these endeavors.

Affiliated with

American Association for the Advancement of Science (AAAS),
American Junior Academy of Sciences (AmJAS),
National Association of Academies of Science,
National Association of Biology Teachers (NABT),
National Science Teachers Association (NSTA),
and the Iowa Space Grant Consortium (ISGC)

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Special Thanks

Thank you to the following organizations & individuals for contributions to the meeting:

Dr. Dan Kinney, President, Iowa Central Community College
Kelli Reuter, Assistant to Vice President of Instruction, Iowa Central Community College
Julie Ehresmann, ICCC Campus Host

Mark Anderson, University of Iowa
Ryan Clark, Geological Society of Iowa
John Doershuk, University of Iowa
Jeanne Gibson, UnityPoint Health
Trista Peitzman, IPTV
Sue Thompson, UnityPoint Health
Robert Watson
Jeff Weld, Governor’s STEM Advisory Council

Student Volunteers from Iowa Central Community College

Thank you to all section chairs, vice chairs and committee members and all who generously
donated and/or purchased items in the IJAS Silent Auction.

2013 Corporate Members

Platinum
Rockwell Collins
Bronze
BMC Aggregates, L. C.
Welcome to the 126th Annual Meeting of the Iowa Academy of Science.

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IJAS Competition

The IJAS Competition takes place from 8:00-10:30 on Friday morning. Please feel free to browse the IJAS posters and/or attend IJAS presentations. Seniors compete for one of two $500 college scholarships. Two 9th-11th graders are selected to represent Iowa at the American Junior Academy of Science/American Association for the Advancement of Science National Conference. Middle school students compete for the Most Promising Young Scientist award, which is a certificate and an IJAS T-shirt. All of these awards are made possible through support from the Iowa Space Grant Consortium, the Iowa Science Teaching Section of IAS, the IJAS Silent Auction, and Board allocated funds. The Iowa Space Grant Consortium has awarded IJAS $8,000 in support of the Iowa Junior Academy of Science for 2013-2014.

Iowa Delegates & Alternates to the 2014 AmJAS in Chicago, Illinois

IJAS Delegates:
- Michelle Hu, Ames High School
- Rachel Kim, Ames High School

Also attending:
- Jay Amin, Ames High School

2013-2014 Starr Student Research Grants

IAS Member Frank Starr established the Starr Student Research Grants to support science fair research. IJAS Members submit grant proposals to the IAS Student Programs Committee. The committee grants awards of up to $200 per project to assist students in gaining access to items not normally available in their science classrooms. The committee also provides feedback and suggestions for improving their project plans. This year the Student Program Committee awarded 30 grants to the following awardees:

- Shelly Baldrige
- Cheyenne Ball
- Aaron Bendickson
- Micaela Bryant
- Kelsey Bryant
- Lane Campbell
- Tilden Chen
- Maya Chen
- Tiffany Chu
- William Crow
- Kristyn Eaves
- Morgen Feeley
- Zoe Hamstreet
- Sabrina Hegelheimer
- Rachel Junck
- Patrick Jurenka
- Andrew Kim
- Breanna Kramer
- Cassie Danielle Krebill
- Tessa Lamartine
- Charlotte Lenkaitis
- Addison Loges
- Isaac Moeller
- Marcus Reecy
- Nathan Schmidt
- Binaya Shrestha
- Agnes Suza
- Grace Synder
- Brian Todey
- Mallory Wills

National Youth Science Camp

For more than forty years, two seniors from every state have been selected to attend the National Youth Science Camp in West Virginia. The Iowa Academy of Science assists the Iowa Governor’s Office by selecting Iowa’s Delegates to NYSC. Delegates spend a month at the camp attending guest lectures, developing their own research projects and meeting scientists from many fields. Congratulations to this year’s Iowa delegates.

Iowa’s 2014 Delegates:
- Ayenna Cagaanan, Fort Dodge Senior High School
- Amy Huynh, Ankeny High School
Advancements in Precision Agriculture

Amy Kaleita-Forbes, Ph.D.
Associate Professor
Agricultural & Biosystems Engineering
Iowa State University
Ames, Iowa

When you drive past or fly over a typical Iowa farm, it may seem very uniform - a flat piece of ground with a carpet of more or less identical plants on it. But in fact, lurking underneath that apparent sameness is a considerable amount of variability. Soil texture is different from one location to the next, in some places sandier, in other places more clayey. Soil fertility varies by soil texture and soil condition. Even small differences in topography influence the way water moves across and is stored in the soil, and flowing water can erode the soil, taking some of the nutrients with it. Precision agriculture is a method of farming that attempts to manage or capitalize on all that variability, tailoring treatment of individual small sections of the farm to that site's unique characteristics. While precision agriculture concepts have been practiced to varying degrees for several decades now, continued advancement is necessary to maximize the potential of this approach: optimizing productivity and minimizing negative effects on the environment. Key technologies include sensing and monitoring systems, decision support systems that turn observed data into actionable information, and variable application technologies for managing inputs to the field.

About Amy Kaleita-Forbes

Amy Kaleita is an Associate Professor of Agricultural and Biosystems Engineering at Iowa State University. She teaches courses in programming, numerical methods in agricultural engineering, and soil and water conservation. Her research is in the area of information technology for precision conservation. The natural environment is highly spatially and temporally variable, and being able to determine what land management strategies will be the most suitable in a particular location requires that we be able to characterize the variable factors at an appropriate scale, and synthesize data with respect to their influence on hydrology.

Dr. Kaleita's research program includes design of sensing and monitoring systems and utilization of such data in modeling and decision support systems. It is aimed at using robust and smart technology and analysis to maintain or enhance environmental quality (particularly with respect to hydrology) while enabling a safe and sustainable food production system. She received the B.S. degree in Agricultural Engineering from Penn State University in 1997, the M.S. degree in Civil and Environmental Engineering from the University of Illinois at Urbana-Champaign in 1999, and the Ph.D. in Agricultural Engineering from the University of Illinois at Urbana-Champaign in 2003.
IJAS AWARD LUNCHEON
Friday, Noon, Career Education Building (CEB)

Luncheon Program

Iowa's 2013 National Youth Science Camp Delegates, Alternates, and Nominees

Announcement of IJAS Competition Awards
Most Promising Young Scientist
Iowa Delegates to the American Junior Academy of Science, 2015
Iowa Alternates to the American Junior Academy of Science, 2015
IJAS $500 Senior Scholarships

Recognition of all IJAS Members, Judges, and Sponsors

IAS BUSINESS MEETING
Friday, 1:30-2:15 p.m., Applied Science and Technology Building (AST), Room 107

Program
Call meeting to order
Welcome
Approval of agenda
Recognition of deceased members and moment of silence
Introduction of board members
Honor Past-President and outgoing board members
Announcement of election results
Recognition of New Fellows
Executive Director Annual Report
Discussion
New Business
Adjournment

Necrology
April 2013—Present

David V. McCalley, June 9, 2013
John W. McCurdy, June 19, 2013
Cliff Chancey, October 19, 2013
Otto Knauth, August 22, 2013
David Metzler, September 26, 2013
Paul J. Horick, January 31, 2013
SPECIAL EVENTS

Friday & Saturday

Dare to Discover Mobile Museum
Parking lot southeast of the BHS Building
Open: Friday 3:00 pm — 6:30 pm
Saturday 8:00 a.m.—1:30 p.m.

Be among the first to view this new science education and public outreach museum from the University of Iowa. Housed in a custom designed 38 foot Winnebago RV this mobile museum will feature rotating year-to-year exhibits. On its inaugural run the museum will include exhibits on Territorial Iowa History, Ice Age Mammals, and the Glenwood Archeological Culture. The exhibit will be open to IAS Annual Meeting attendees and the public free of charge both Friday and Saturday.

Investigating Science at Iowa Central Community College
Iowa Junior Academy of Science Event
Friday, 1:20-2:20, BHS 107, Biofuels Testing Lab (BHS), BHS 115

Biotechnology is a growing field and has many applications in Iowa, such as bio-fuels, fermentation technology, and DNA manipulation. During this activity students will also learn about other career opportunities in different science related fields and hear about Iowa Central's state-of-the-art two year Biotech and Medical Technology programs. Students will have the opportunity to practice important skills in ICCC's fully equipped labs, take a tour of our Bio-fuels Lab and other hands on activities.

Iowa Department of Education State Science Consultants Meeting
1:30 p.m. to 3:30 p.m., Applied Science and Technology Building (AST), Room 004

IAS Bookstore
Open Friday 7:30 — 4:30 & Saturday 8:00—3:30

Browse the IAS Bookstore at your leisure for books of general and scientific interest. The IAS bookstore is operated in conjunction with LarryStones.iowa.com. Twenty percent of the proceeds from sales at the conference are returned to IAS.

Larry specializes in selling books on Iowa natural resources topics. But he also handles a number of general interest titles focusing on the environment, conservation, sustainable agriculture, and environmental education.
IAS VOLUNTEERS

2013 to 2014 Section Chairs and Vice Chairs

Mark Anderson                    Anthropology Section Chair
Vacant                          Anthropology Section Vice Chair
Stephanie Toering-Peters       Cellular, Molecular & Microbiology Section Chair
Gary Coombs                    Cellular, Molecular & Microbiology Section Vice Chair
David Arnett                   Chemistry Section Chair
Kristopher Keuseman            Chemistry Section Vice Chair
Paul Kimball                   Community College Biologists Section Chair
Vacant                         Community College Biologists Section Vice Chair
John Pearson                   Ecology and Conservation Section Chair
Lloyd Crim                     Ecology and Conservation Section Vice Chair
Thomas Rudolphi                Engineering Section Chair
Al Ratner                      Engineering Section Vice Chair
Melinda Coogan                 Environmental Science & Health Section Chair
Nicole Palenske                Environmental Science & Health Section Vice Chair
Teri Wiese                     Geology Section Chair
John Dawson                    Geology Section Vice Chair
Eric Hall                      Iowa Science Teaching Section Chair
Kelen Panec                    Iowa Science Teaching Section Vice Chair
Paulina Mena                   Organismal Biology Section Chair
Sara Sheeley                   Organismal Biology Section Vice Chair
Kho-Ho (Tom) Yang               Physics, Atmospheric & Space Sciences Section Chair
Vacant                         Physics, Atmospheric & Space Sciences Section Vice Chair
Jackie Brittingham             Physiology and Health Sciences Section Chair
Michael Lyons                  Physiology and Health Sciences Section Vice Chair

Thank You
Volunteers
IAS VOLUNTEERS

 Committees on Committees and Elections
Nadine Weirather, Chair & Liaison

(2014) Chad Fields
(2014) De Anna Tibben
(2015) Alicia Schiller
(2015) Nick Stoynoff
(2016) Paul Mayes
(2016) Yvette McCulley

 Committees on Committees and Elections
Nadine Weirather, Chair & Liaison

Membership Committee
Liaison – Kavita Dhanwada

(2014) Matt McAndrew
(2014) Chris O’Connell
(2015) Gary Fulton
(2015) Rasika Mudalige
(2016) Tammie Atchison
(2016) De Anna Tibben, Chair

 Conservation and Preserves Committee
Liaison – Johanna Foster

(2014) Lee Burras
(2014) Doug Karlen
(2015) Rick Hall
(2015) Yvette McCulley
(2016) Rebecca Christoffel, Chair
(2016) Jeremy Allar

 Conservation and Preserves Committee
Liaison – Johanna Foster

Recognition and Awards Committee
Liaison – Tom Ervin

(2014) Paul Mayes, Chair
(2014) Clinton Meyer
(2015) Carol Boyce, Acting Chair
(2015) Mary Lestina
(2016) Karen Wignall
(2016) Traci Maxted

 Finance Committee
Liaison – Chad Heinzel

(2014) Peter van der Linden
(2014) Pat Finnerty
(2015) Andrew Brittingham
(2015) Jeanne Rogis
(2016) Jeff Weld
(2016) Daryl Smith, Chair

 Finance Committee
Liaison – Chad Heinzel

Societal Issues Committee
Liaison – Tom Rosburg

(2013) Todd Tracy
(2013) Paul Bartelt
(2014) Sherman Lundy
(2014) Sara Coleman
(2015) Melinda Coogan, Chair
(2015) Mary Skopec

 Iowa Science Foundation Committee
Liaison – Ray Anderson

(2014) Ryan L. Rehmeier, Acting Chair
(2014) Johanna Foster
(2015) Alison Beharka
(2015) Tom Fenton, Chair
(2016) Kurt Rosentraer
(2016) Corbin Zea

 Iowa Science Foundation Committee
Liaison – Ray Anderson

 Student Programs Committee
Liaison – Mahdi Al-Kaisi

(2014) Heidi Peterson
(2014) Todd Tracy
(2015) Muhammad Spocter
(2015) Felicitas Avendano
(2016) Mario Affartigato
(2016) Kelen Panec, Chair

 2013—2014 ESTA Committee

Tom Ervin, Chair
Ernie Schiller
Mike Zeller
Kimberly Gasaway
Doug Herman
Gale Vermeulen
Mike Clough

Outgoing spring denoted in parenthesis.
See IAS By Laws for a description of committee duties.
SYMPOSIUM A
Friday, 2:30-4:30, Bioscience & Health Science Building (BHS), Room 105 (Auditorium)

Communicating Science: Tools for Scientists and Teachers

- Bryan Bauer, Manager, Iowa Public Television's Online Media & Digital Learning Team
- Jennifer Koska, Participant Experience Manager, Science Center of Iowa
- Thomas O'Donnell, Science and Technology Writer, Krell Institute

With a background in instructional design and educational technology, Bryan Bauer has been producing interactive educational media for nearly 20 years. At Iowa Public Television, he has created award-winning educational science projects for broadcast, DVDs, websites, interactive games, and online courses for K-12 and general audiences. Bryan will share several strategies for crafting a message, using different online publishing tools, and reaching new audiences with your science content.

Jenny Koska is the Participant Experience Manager at the Science Center of Iowa (SCI). She trains and oversees the floor staff at SCI. In addition, she facilitates Portal to the Public. Portal to the Public is a professional development program designed to help informal science institutions bring scientists and their public audiences together in face-to-face interactions that promote appreciation and understanding of current scientific research and its application. Her portion of the symposium is going to focus on the importance of science communication in informal learning environments with an emphasis on the Portal to the Public Program that has been implemented at SCI.

Thomas R. O'Donnell is a science and technology writer for the Krell Institute in Ames, where he helps produce magazines, websites, and other material related to computational and physical science. He previously was an editor and reporter at the Des Moines Register, where he last worked as medicine and science reporter. He also has written for the Plant Sciences Institute at Iowa State University and other clients. In this talk, O'Donnell will discuss why merely laying out the facts no longer is enough to get people to embrace science and its conclusions; science communicators must, for lack of a better word, "touch" people. He'll discuss why scientists and teachers should engage the public and how to work with the media to effectively convey research and educate news consumers.
Iowa Discoveries: Earth to Interstellar Space

After 36 years Voyager 1 Reaches Interstellar Space

Thirty-six years after launch, in one of the greatest space achievements of all time, the NASA Voyager 1 spacecraft reached interstellar space. Professor Gurnett will discuss his role in the Voyagers 1 and 2 missions launched in 1977. After completing the "Grand Tour" of the outer planets in 1989 the mission became the "Voyager Interstellar Mission" with the objective of reaching interstellar space. In April 2013, the Iowa instrument on Voyager 1 made the critical observations—it had reached interstellar space.

Don Gurnett is the J.A. Van Allen/R.J. Carver Professor of Physics in the Dept. of Physics and Astronomy at the U. of Iowa, where he has been on the faculty since 1965. He specializes in experimental space research and has participated in more than 30 NASA spacecraft projects, most notably the Voyager 1 and 2 flights to the outer planets, the Galileo mission to Jupiter, and the Cassini mission to Saturn. He has received numerous research and teaching awards; the 1994 Iowa Board of Regents Award for Faculty Excellence, elected a member of the National Academy of Sciences in 1998, and is member of the American Academy of Arts and Sciences.

Titan: A Prebiotic Chemical Factory?

Titan, the largest moon of Saturn, is the only other terrestrial world, aside from Earth, in our solar system that has a dense atmosphere made primarily of nitrogen. Visits by the Voyager and Cassini-Huygens missions have revealed a rich organic chemical environment driven by the photochemistry of methane. In many ways Titan resembles a primordial Earth in a deep freeze. The idea of detecting biologically relevant molecules is an exciting prospect for gaining insight into our own beginnings.

Joshua Sebree is an assistant professor at the University of Northern Iowa currently setting up an astrochemistry research lab with a focus of detecting biological molecules created under the abiotic conditions at Titan.

An Innovative Solution to NASA's Asteroid Grand Challenge

Due to the Chelyabinsk meteor event that occurred in Russia on February 15, 2013 and a near miss of asteroid 2012 DA14 on the same day, there is now a growing national and international interest in developing a global plan to protect the Earth from a catastrophic impact by a hazardous asteroid or comet. On June 18, 2013, NASA announced an Asteroid Grand Challenge on finding all asteroid threats to human populations and knowing what to do about them. This talk describes an innovative, yet practical, solution to the Asteroid Grand Challenge. This research is supported by NASA's Iowa Space Grant Consortium and NASA Innovative Advanced Concepts (NIAC) Phase 2 program.

Bong Wie is the Vance Coffman Endowed Chair Professor of Aerospace Engineering and the founding Director of the Asteroid Deflection Research Center at Iowa State University. In 2006, the American Institute of Aeronautics and Astronautics (AIAA) presented Professor Wie with the Mechanics and Control of Flight Award for his innovative research on advanced control of complex spacecraft such as agile imaging satellites, solar sails, and large space structures. He is the author of an AIAA textbook Space Vehicle Dynamics and Control (second edition, 2008).
Hydrology of Iowa as affected by Corn and Bean Agriculture

Impacts of agricultural land use/land cover change on water resources in Iowa

Land cover in Iowa changed when settlers first broke the native prairie in the mid-1800's and changed again in the mid 1900's when diverse agricultural rotations were replaced by row crops of corn and soybeans. The affected the annual water budget and stream flow hydrographs in many Iowa watersheds as the landscape shifted from an infiltration and evapotranspiration dominated runoff and excess water yield domination. Diverse agricultural activities continue to modify the hydrology of agricultural landscapes today. In this presentation, the effects of land use and land cover changes from agricultural intensification on surface and groundwater flow will be discussed at a variety of spatial and temporal scales in Iowa and the U.S. Midwest.

Keith Schilling is a Research Scientist at the Iowa Geological Survey located at the University of Iowa in Iowa City. He has a PhD in Geoscience from the University of Iowa and a M.S in Water Resources at Iowa State University. His research interests include surface and groundwater interaction, watershed analysis and the effects of land use/land cover water flow and quality.

Historic Changes in Iowa's Water Quality

Iowa's hydrology during the past 100 years has altered the chemical and biological characteristics of Iowa's streams. During pre-settlement time periods, prairie landscapes slowed and absorbed rainfall. Streams and creeks were largely fed by groundwater flows. Subsequent alteration of Iowa's landscape has increased overland flow and erosion along with nutrient delivery and other organic contaminants such as pesticides. Enrichment by nutrients has led to drinking water concerns with taste and odor issues. Flashier hydrology has also impacted aquatic populations by reducing critical habitats.

Mary Skopec is a senior research scientist for the Water Monitoring and Assessment Section at the Iowa Department of Natural Resources, Geological Survey Bureau. She has worked on water quality projects including the development of a statewide database to track pesticide occurrences in water resources. Dr. Skopec currently coordinates the WMAS analyses of data from the statewide Ambient Water Monitoring Program and serves as the IOWATER Volunteer Monitoring Program Coordinator. Dr. Skopec earned an interdisciplinary PhD in environmental science from the University of Iowa.

Non-polluting, Non-flooding Cropping Models

To mitigate erosion, nutrient pollution, and flooding coming from the corn and bean row crop model, Bob will discuss crops and cropping systems which exist today, and if adopted today, will foster a non-polluting, biologically benign and beneficial, soil building agriculture without sacrificing our food and manufacturing needs.

Bob Watson is an environmental activist from Decorah who makes his living in the wastewater industry. He has been instrumental in the Iowa Water Environment Association supplying K-12 science teachers, free of charge, with supplemental curriculum covering water, wastewater, groundwater, surface water, and wetlands. He also initiated DMACC's new water and wastewater curriculum which is training a new generation of water and wastewater operators.
Anthropology Section

1. EXPLOITATION OF BIRDS BY LATE PREHISTORIC FORAGER-FARMERS ALONG THE CENTRAL DES MOINES RIVER
Amanda Bernemann

2. I-SITESGOV: EXPANDING ACCESS TO THE IOWA SITE FILE FOR PROJECT PLANNERS
John F. Doershuk, Mary De La Garza and Colleen Eck

3. FAR FROM HOME: USING 87Sr/86Sr ISOTOPE RATIOS TO UNDERSTAND MOBILITY PATTERNS IN LATE PREHISTORIC SPAIN
Matthew R. Purl¹, Nicholas R. Wilson¹, Anna J. Waterman¹, Jonathan T. Thomas², Pedro Díaz-del-Rio³, and David W. Peate²

4. ARCHAEOLOGEE: AN ENVIRONMENTAL EDUCATION PROGRAM FOR PUBLIC LANDS MANAGEMENT AGENCIES AND AMERICAN INDIAN SCHOOL CHILDREN
Elizabeth C. Reetz

5. THEORETICAL ORIGINS OF PROJECTILE POINT TYPOLOGIES IN IOWA
Benjamin Shirar

6. A FIRE-CRACKED PUZZLE: TESTING THE EFFICACY OF XR-F SCANNING TO FACILITATE REFITTING
Luke Stroth

7. SEARCHING FOR A NATION: SOUTH SUDANESE REFUGEES IN DES MOINES
Edgar Valles

Cellular, Molecular & Microbiology Section

12. THE ANTIMICROBIAL EFFECT OF BORIC ACID ON TRICHOMONAS VAGINALIS
Andrew Brittingham and Wayne A. Wilson

13. THE TELOMERASE INHIBITOR MST-312 HAS AN ANTIVIRAL EFFECT ON HERPES SIMPLEX VIRUS
Phonphanh Dedthanou, Prajakta Pradhan, and Marie L. Nguyen

14. PURIFICATION AND CHARACTERIZATION OF A β-FRUCTOFURANOSIDASE FROM THE PARASITIC PROTIST TRICHOMONAS VAGINALIS
Michael Dirks, Michael P. Boyer, Andrew Brittingham, and Wayne A. Wilson

15. IS MRSA AMONG US?
Megan Feuchtenberger, Laura Hurley, Emily Nienhuis, Kelley Hurley, Elizabeth Heeg, and Todd Tracy

16. EFFECTS OF BLOODROOT (SANGUINARIA CANDADENSIS) ON THE HUMAN PATHOGENIC FUNGUS CANDIDA ALBICANS
Austin T. Granatowicz, Samuel W. Shelton, Carter M. Tegeler, Aaron A. Brown, and Tammy d'Artenay
POSTER SESSION
Friday, 4:30 p.m., Career Education Building (CEB)

Cellular, Molecular & Microbiology Section continued

17. BORIC ACID HAS STRONGER INHIBITORY ACTIVITY ON THE HYPhAL THAN ON THE YEAST FORM OF THE DIMORPHIC FUNGUS CANDIDA ALBICANS
Alexander J. Hjelmaas1, Celia S. Venezia2, Michael P. Boyer3, and Martin Schmidt3

18. COMPLEMENT COMPONENT C1Q REGULATES MACROPHAGE INFLAMMATORY SIGNALING
Sean D. O'Connor, Holly Hulsebus, and Suzanne S. Bohlson

19. TRANSFORMATION OF SPECIES FROM FIVE BIOLOGICAL KINGDOMS USING AEROSOL BEAM INJECTION AND PARTICLE BOMBARDMENT
Jena Peters and James Hampton

20. IDENTIFICATION OF CANDIDATE IRON DEPENDENT PROTEIN REGULATORS OF CANONICAL WNT SIGNALING
Kaylee Vitale1, Jenny Brewer1, Ivana Mihailek2, and Gary Coombs1

21. INVITRO EFFECTS OF MLCN2 EXPRESSION
Michael Zeller, Ilchung Shin, Lee Bendickson, and Marit Nilsen-Hamilton

Chemistry Section

31. SYNTHESIS OF THIOL PHOSPHONAMIDATE ANALOGS
Michael Brus, Jennifer Fulton, and Stephen Sieck

32. GAS-PHASE HYDROGEN DEUTERIUM (H/D) EXCHANGE OF PROTONATED AND ALKALI-METALATED HISTIDINE CONTAINING DIPEPTIDES
Bao Ying Chen, Elizabeth Phelan, Max Calenberg, and Elaine Marzluff

33. EFFECT OF MOISTURE ON THE CRYSTALLINE STRUCTURE OF PURE MONOGLYCERIDES
Hannah Stonewall and Abebe Mengesha

Ecology & Conservation Section

38. POPULATION GENETICS OF GRAY FOX (UROCYON CINEREOKARSTIUS) IN THE MIDWEST, USA
Jamison Ash, Thando May, and Dawn Reding

39. WINNERS AND LOSERS: PLANT SURVIVAL DURING PRAIRIE RECONSTRUCTION IN DROUGHT CONDITIONS
Brody Janssen, Stephanie Griffith, Jessica Riebkes, Derek Miner, Olivia Schouten, and Russ Benedict

40. IMPACT OF COMMON PLANTING TECHNIQUES ON PRAIRIE RECONSTRUCTION IN DROUGHT CONDITIONS
Derek Miner, Olivia Schouten, Jessica Riebkes, Stephanie Griffith, Brody Janssen, and Russ Benedict

41. THE EFFECTS OF VERMICOMPOST ON TOMATO PLANT GROWTH AND THE HERBIVORE TOBACCO HORNWORM
Sarah Kielly, Mackenzie Moore, Nancy Seeberg, Kellie Solberg, and Jennifer Maxwell
42. CONTINUED STUDIES OF HOME RANGE AND HABITAT USAGE OF HATCHLING AND JUVENILE ORNATE BOX TURTLES (TERRAPENE ORNATA) IN IOWA
Nikita K. Martinson¹, Adam G. Goats², Rachel H. Fendrich¹, Kelsey King¹, Sara Doerman¹, Alex Karr², C. Ochs, S.A. Mcollum, and N.P. Bernstein²

43. DETERMINING THE TRENDS IN GENE FLOW BETWEEN TWO POPULATIONS OF SOUTHERN FLYING SQUIRRELS (GLAUCOMYS VOLANS) IN FRAGMENTED HABITATS OF EASTERN IOWA
Maria Mondragon, Stephany Miller, Rasika G. Mudalige-Jayawickrama, and Gerald L. Zuercher

44. UNDERSTANDING GRASSLAND INTERACTIONS USING BUTTERFLY RESPONSE TO VARIATIONS IN NECTAR PRODUCTION AND FLOWER DIVERSITY
Toni Proescholdt, John Delaney, and John Delaney

45. EARTH, TREES, AND FIRE: ECOLOGICAL INTERACTIONS AT NIOMARA VALLEY PRESERVE
Jordan Reinders, Kyle Cleveringa, Ben Schmidt, Emily Stricklin, Sarah Kaltenbach, Laurie Furlong, and Todd Tracy

46. SEEDING RESTORATIONS: EVALUATING SEED VIABILITY TO IMPROVE RESTORATION OUTCOMES
Jessica Riebkes¹, Rebgecca Barak¹, and Andrea Kramer²

47. THE EFFECTS OF MYCORRHIZAL FUNGI ON THE GROWTH AND SURVIVAL OF PRAIRIE SEEDLINGS DURING DROUGHT CONDITIONS
Olivia Schouten

48. STATUS OF FRANKLIN'S GROUND SQUIRRELS (POLIOCITELLUS FRANKLINII) IN IOWA
James C. Stroh and Madison Knight

49. SPECIES DISTRIBUTION MODELING OF CLARKIA XANTIANA: REFINING CLIMATE PREDICTORS AND PREDICTING FUTURE DISTRIBUTIONS UNDER CLIMATE CHANGE
Jordan L. Young and Vincent M. Eckhart

Engineering Section
54. DISCRETE-EVENT SIMULATION APPLIED TO THE DESIGN AND OPTIMIZATION OF BIOMASS-TO-BIOREFINERY SUPPLY CHAINS
Gabriel Bravo-Palacios, Mark Mba Wright, and Robert C. Brown

55. THE IMPACT OF LEARNING RATES ON THE PRODUCTION COSTS AND OPTIMAL SIZE OF BIOREFINERIES
Tannon Daugaard, Lucas A. Mutti, Mark M. Wright, Robert C. Brown, and Paul Componation

56. ENERGY EFFICIENT DEHUMIDIFICATION BY SOLAR DRIVEN DESSICANT SYSTEMS
Ryan Everly
POSTER SESSION
Friday, 4:30 p.m. Career Education Building (CEB)

Engineering Section continued
57. A TECHNO-ECONOMIC ANALYSIS OF BIO-OIL STABILIZATION FOR INSERTION INTO PETROLEUM REFINERIES AND UPGRADING TO TRANSPORTATION FUELS
Wenqin Li, Mark Mba Wright, and Robert Brown

58. REACTION KINETIC DEVELOPMENT FOR BIOMASS THERMALY DECOMPOSING PROCESSES
Fenglei Qi, and Mark Mba Wright

Environmental Science & Health Section
64. TESTING FOR PRESENCE OF TICK-BORNE DISEASE AND COINFECTION
Ellen Behrens

65. HIGH VELOCITY HAND DRYERS AND MICROBES, WHAT'S THE RUB?
Carly J. Gilliland, Brian T. Bristow

66. TRICLOSAN EFFECTS ON ALGAE IN STORM LAKE, IOWA, WWTP RECEIVING STREAM
Ashley Rogers, Chelsey Snyder, and Melinda Coogan

Geology Section
72. ELECTRICAL RESISTIVITY TOMOGRAPHY AS A HYDROGEOPHYSICAL TOOL FOR CHARACTERIZING SURFACE WATER-GROUNDWATER INTERACTIONS
Samuel J. Smidt, and Adam S. Ward

Iowa Science Teaching Section
75. READY FOR THE NEXT GENERATION SCIENCE STANDARDS?
Ken L. Turner, Jr.†, and Amy Van Deuren‡

Organismal Biology Section
77. WNT PATHWAY DISRUPTORS CAUSE DUPLICATION OF AXIS IN NEMATOSTELLA VECTENSIS
Madelyne Besack, John Greavees, and Jacqueline Brittingham
POSTER SESSION

Friday, 4:30 p.m., Career Education Building (CEB)

Physics, Atmospheric & Space Sciences Section

81. PHOTOMETRIC AND SPECTROSCOPIC MEASUREMENTS SUPPORTING THE MODEL OF AN ECLIPSING BINARY STELLAR SYSTEM FOR 68 HERCULIS
Kenneth W. McLaughlin, and Janak Panthi

82. STUDIES OF STAR FORMATION REGIONS IN THE MILKY WAY GALAXY
Steven R. Spangler and Allison H. Savage

Physiology & Health Sciences

87. THERE'S SOMETHING IN THE WATER: EFFECTS OF ENDOCRINE DISRUPTING CHEMICALS (EDCS) ON OFFSPRING VIABILITY IN ADULT ZEBRA FINCHES, TAENIOPYGIA GUTTATA
Aubrey Lambach, Kristin Dahlem, Rebecca Rabideaux, Rebekah Reynolds, Ann Den Hartog, Avery Tucker, and Debora Christensen

88. THE EFFECT OF A WATER AEROBICS EXERCISE REGIME ON FUNCTIONAL MOBILITY
Delia Salomon, Matt Schaeffer, and Liz Queathem

89. POLYMORPHISM OF HUMAN DIABLO GENE AND ITS COMPARATIVE EXPRESSION IN NORMAL AND CANCER TISSUES
Paige M. Triervieler, and Rasika G. Mudalige-Jayawickrama

Mark your calendars and join us for the
Iowa Council of Teachers of Mathematics and
Iowa Academy of Science
Iowa Science Teaching Section

2014 ICTM-ISTS Math & Science Conference:
Challenge, Change, Opportunity
October 21—22, 2014
Iowa State University
Ames, Iowa
www.iacad.org/ists
SOCIAL HOUR
Friday, 4:45 p.m., Career Education Building (CEB)

Join colleagues and friends for refreshments and conversation during our annual social hour.

Be sure to visit the Senior Poster Presentations.

PRESIDENT’S BANQUET
Friday, 6:00 p.m., Career Education Building (CEB)

President Gale Vermeulen Presiding

Program

Dinner

Welcome and Introductions, Craig Johnson, Executive Director
Executive Director Remarks
President’s Address by Gale Vermeulen
New Fellow Recognition
Marcy Seavey
University of Northern Iowa
Distinguished Awards Presentations
Presentation of Incoming President’s Gavel by Gale Vermeulen
Incoming President’s Address by Nadine Weirather
Closing Remarks
The contributions of Iowa's Scientific Community have transformed our world view, protected our natural heritage and fostered succeeding generations of eager science researchers. In recognition of the best contributions of Iowans to science research, science education, and service to science, the Iowa Academy of Science established the Distinguished Science Awards Program in 1980. The Recognition and Awards Committee accepts nominations for the four award categories through the first Friday in February each year and makes recommendations for awards to the IAS Board of Directors. The Awards are announced and the winners celebrated at the President's Banquet during the Iowa Academy of Science Annual Meeting.
Understanding the Peopling of the Americas: A Discourse Between an Archeologist and Geneticist

Historically, scientific explanations about who were the first Americans, when did people first arrive or how did people get here have been based on a single line of evidence. Very few studies have attempted to explain the totality of evidence across different disciplines. We will explore areas in which genetic and archaeological evidence provide complementary as well as contradictory conclusions about the nature and structure of the peopling process. We will highlight areas in which the archaeological and genetic data provide evidence for similar conclusions about Native American prehistory as well as areas of disjuncture which indicate different conclusions. Importantly, we will stress areas where archaeological and genetic evidence disagree are likely the most productive avenues for future research.

Matthew Hill, PhD.
Assistant Professor
Department of Anthropology
University of Iowa
Iowa City, Iowa

Matthew Hill is an Assistant Professor in the University of Iowa Department of Anthropology, where he teaches various courses on North American archaeology and human-environmental interactions. He received a MA from the University of Kansas, and a Ph.D. from the University of Arizona. His research focuses on human-environmental interactions on a landscape scale, expressed in long-term behavioral changes (spanning from the end of the Ice Age to the historic period) across various environmental settings (Great Plains grasslands, Rocky Mountains, Desert Southwest). His active research topics include adaptations of Puebloan migrants to western Kansas around AD 1700 and long-term changes subsistence practices among Great Plains and Rocky Mountains big game hunters.

Andrew Kitchen, PhD.
Assistant Professor
Department of Anthropology
University of Iowa
Iowa City, Iowa

Andrew Kitchen graduated from The Johns Hopkins University in 2001 (B.S., Biomedical Engineering). He obtained a M.Sc. (Biology) from the University of Oxford (Hertford College) in 2003, M.A. (2004), a Ph.D. (2008) in Anthropology (University of Florida), post-doc in Eddie Holmes' lab (Center of Infectious Disease Dynamics) at the Pennsylvania State University, and came to the University of Iowa in 2012. Dr. Kitchen is interested in the evolutionary history of modern humans. He uses human and pathogen genetic data to investigate historical population dynamics including behaviors and shifts in human ecology leading to the emergence of novel pathogens. His current research is on the molecular evolution of pathogens including macroevolutionary patterns and dynamics of human populations using contemporary and ancient DNA data.
Obstructive Sleep Apnea
James C. Meyer, D.O.
Pulmonology, Sleep Medicine
UnityPoint Clinic
Fort Dodge, Iowa

Obstructive sleep apnea (OSA) is a common chronic disorder often requiring lifelong care. Features include signs of disturbed sleep (snoring, restlessness or resuscitative snorts) and symptoms (daytime sleepiness, fatigue or poor concentration). OSA is an important disorder because patients are at increased risk for poor neurocognitive performance and adverse medical outcomes. Severe untreated OSA is associated with increased all-cause and cardiovascular mortality.

This presentation will discuss OSA epidemiology, risk factors, pathophysiology, clinical manifestations, diagnosis, treatment and follow-up care. There will be additional technical information provided by the supervisor of the UnityPoint Health/Trinity Regional Medical Center Sleep Disorders Center. Time will be allotted for any questions or comments following the presentation.

About James C. Meyer

Prior to joining UnityPoint Clinic Pulmonology in 2000, Dr. Meyer was a staff pulmonologist at Botsford General Hospital in Farmington Hills, Michigan, and Garden City Hospital in Garden City, Michigan, for six years. Dr. Meyer received his medical degree from Kirksville College of Osteopathic Medicine in Kirksville, Missouri, after completing his Bachelor of Science at the University of Michigan in Ann Arbor. Dr. Meyer and his wife Ann have been married for 19 years and are the proud parents of their son Jacob who will be a Freshman at Iowa State University this fall and is planning to pursue a career in healthcare, mostly likely as a physician. Dr. Meyer has held many leadership roles while in Fort Dodge, including completing his final year on the UnityPoint Health-Fort Dodge Board of Directors and has also been President of the Trinity Regional Medical Center Medical Staff twice. He is a member of the UnityPoint Health Quality Committee and is the Vice Chair of the UnityPoint Clinic-Fort Dodge Operating Committee. Dr. Meyer serves as Medical Director of UPH/TRMC Respiratory Care and Sleep Disorders and of UPH/Trinity Hospice. He is a member of the First American Bank Advisory Board.
2014 ESTA LUNCHEON
Saturday, Noon—1:00 p.m. Career Education Building (CEB)

2014 Excellence in Science Teacher Awards

Ariana Krueger
Dallas Center—Grimes
Middle School
Middle/Junior High Science

Chris Like
Bettendorf High School
Physical Science

Brooke Maine
Dallas Center—Grimes
High School
Life Science

Tami Plein
Great Prairie Area Education Agency
Science Supervisory

Patrice Teigland
North Ridge Elementary
Dallas Center—Grimes
Elementary Science

Michael Todd
Ames High School
Earth/Space/Environmental Science

Shelly Vanyo
Boone High School
General/Multiple Science

About the Iowa Academy of Science ESTA Awards
The Iowa Academy of Science Excellence in Science Teaching Awards were founded in 1969. Outstanding teachers of all grade levels and areas of science are recognized for their work and innovations in science education. Awards are presented in seven categories: Earth/Space/Environmental Science, Elementary Science, General/Multiple Science, Life Science, Middle/Junior High Science, Physical Science, and Science Supervisory. One award may be presented annually in each category except Elementary Science in which up to two awards may be presented. ESTA Winners demonstrate, through knowledge and practice, the characteristics of an exemplary educator. Awardees receive a plaque and a $200 award. Nominations are encouraged from administrators and colleagues or a teacher may self-nominate. Nominations are accepted throughout the year with the deadline for nominations being January 31st. Download the ESTA Brochure on the IAS Website at www.iacad.org for more details.
FIELD TRIP
Saturday, 1:30 p.m., Parking Lot #5 southwest of the Bioscience & Health Science Building (BHS)

Geological Society of Iowa
Field Trip
Highlights of the unique geology of the
Fort Dodge area
1:30 p.m. Saturday

Sign up Friday at the Registration Desk. Sign-up Saturday only if space is available.

Stop 1 (1 hour)
Soldier Creek Nature Trail at N 5th Street & 5th Avenue N. There will be a short hike to Soldier Creek to view the Jurassic-age “Soldier Creek Red Beds” exposure. We will also walk along the trail upstream (north) towards the skateboard park, crossing over a fault zone along the way, to view a Mississippian-age limestone bedrock exposure.

Stop 2 (1.5 hours)
United States Gypsum Quarry. You will park at the USG office and then shuttle into the pit with 4x4 vehicles. Access a current or former gypsum quarry to view the gypsum bedrock up close. A US Gypsum representative will designate where collecting will be permitted.

Dress Code
Dress for the weather and for walking in uneven terrain. Hard hats will be available. Hard soled boots and/or water-proof muck boots will be needed.

Transportation
Meet in the parking lot south of the BHS Building. The group will travel together but in personal vehicles.
SECTION MEETINGS

See individual sections for room and schedule.

Anthropology Section
8:30-10:40, Bioscience & Health Science Building (BHS), Room 202

8:30 WHY, THERE'S THAT CONFOUNDED SITE: THE RUMMELLS-MASKE CLOVIS SITE, 13CD15
Mark L. Anderson and John F. Doershuk

8:50 THE CARLISLE CLOVIS CACHE: LAND USE, TECHNOLOGICAL ORGANIZATION, AND FAUNAL
EXPLOITATION IN THE MIDCONTINENT
Matthew G. Hill1, Thomas J. Loebel2, and David W. May3

9:10 TEST EXCAVATION OF TWO PREHISTORIC JASPER COUNTY SITES: 2,700 FT IN SPACE SEPARATING 7,200
YEARS IN TIME
Mark L. Anderson

9:30 THE HUNGER GAMES: BOURGEOIS VERSUS THE PROLETARIAT: AMERICA'S SOCIETY IS STRIKINGLY
SIMILAR TO THE SCIENCE FICTION WORLD OF PANEM
Mary Nutter

9:50 POSTER PRESENTATION DISCUSSION

10:20 Section Business Meeting

10:40 Travel to General Session III

11:00 General Session III

12:00 ESTA Award Luncheon

Cellular, Molecular & Microbiology Section
8:20-2:30, Applied Science & Technology Building (AST), Room 107

8:20 PRODUCTION OF SWINE INFLUENSA A VIRUS-LIKE PARTICLES
Amanda Wollert, Mallory Bonstrom, Elizabeth Sommers, Marc Busch

8:40 EFFECTIVENESS OF ETHANOL-BASED HAND SANITIZER EXPOSED TO VARIOUS ENVIRONMENTAL
CONDITIONS
Anna Cleland-Leighton and Mary Shawgo

9:00 GENETIC ANALYSIS OF PUTATIVE CELL DIVISION GENES IN ESCHERICHIA COLI
Jeremy Cline1, Ryan Bezy1, and David Weiss2

9:20 Break

9:40 THE ROLE OF TCP GENES IN GROWTH AND DEVELOPMENT OF ORCHIDS
Lauren T Smith, Tyson J Carter, and Rasika G. Muralige-Jayawickrama
SECTION MEETINGS

See individual sections for room and schedule.

Cellular, Molecular & Microbiology Section continued...

10:00  DELINEATING THE ROLE OF MIR319 MEDIATED TCP GENE REGULATION IN ORCHID FLORAL DEVELOPMENT
       Tyson J Carter¹, Lauren T Smith¹, Rasika G. Muralige-Jayawickrama¹, Marek Sliwinski², and Teresita D Amore³

10:20  Section Meeting

11:00  General Session III

12:00  ESTA Award Luncheon

1:15   DISCOVERING CANDIDATE GENES CAUSING GLAUCOMA BY IDENTIFYING PROTEINS THAT INTERACT WITH SH3PXD2B USING A YEAST TWO-HYBRID SCREEN
       James Estipona¹, Kacie Meyers², Michael G. Anderson², and Alesia Hruska-Hageman¹

1:35   CHARACTERIZATION OF A NOVEL C1Q-DEPENDENT ENGULFMENT PATHWAY IN PRIMARY MOUSE AND HUMAN PHAGOCYTES
       Holly Hulsebus and Suzanne S. Bohlson

1:55   EFFECTS OF A LOW GRAVITY ENVIRONMENT ON CULTURES OF A549 CELLS
       Alexis Balgeman and Marc Busch

2:15   BORIC ACID INHIBITS HYPHAL GROWTH OF C. ALBICANS BY PREVENTING SPITZENKOERPER MAINTENANCE
       Benjamin R. Pointer, Michael P. Boyer, and Martin Schmidt

Chemistry Section
8:40-10:40, Bioscience & Health Science Building (BHS), Room 116

8:40   OPTIMIZING THE PRODUCTION OF BIODIESEL FROM FREE FATTY ACIDS EXCRETED FROM CYANOBACTERIA
       Allison L. Roe and Joseph G. Nguyen

9:00   AN ANALYSIS OF THE THERMOPHILIC MECHANISM OF POTATO TYROSINASE
       Melissa Englert, Mitchell Goff, Maria Mondragon, Chelsea Olson, Kayla Olson, and Mark Sinton

9:20   BREAK

9:40   AN OPEN INQUIRY LABORATORY FOR GENERAL CHEMISTRY STUDENTS: PURIFICATION OF RIVER WATER
       Aaron J. Lacy and Joseph G. Nguyen

10:00  SYNTHESIS, CHARACTERIZATION AND APPLICATION OF PALLADIUM-NACNAC COMPLEXES
       Nicole Morrow and Kristopher Keuseman

10:20  Section Business meeting

10:40  Travel to General Session III

11:00  General Session III

12:00  ESTA Award Luncheon
SECTION MEETINGS

See individual sections for room and schedule.

Community College Biologists
1:15-4:00, Bioscience & Health Science Building (BHS), Room 115

11:00 General Session III
12:00 ESTA Award Luncheon
1:15 Section Business Meeting

Ecology & Conservation Section
8:20-10:40, Applied Science & Technology Building (AST), Room 101

8:20 COMPARING THE ABUNDANCE AND DIVERSITY OF SMALL MAMMALS BETWEEN REMNANT CORRIDORS AND NON-CORRIDOR AREAS
Amy N. Holley, Jennifer L. Stoffel, and Jennifer D. White

8:40 POSSIBLE DISAPPEARANCE OF RED-BACKED VOLES (MYODES GAPPERI) IN WINNEBAGO COUNTY: IS CLIMATE CHANGE A CONTRIBUTING FACTOR?
Andrew Hudson and Paul Bartelt

9:00 NATURAL RESOURCE INVENTORY OF URBAN HABITATS IN DES MOINES PARKS AND OPEN SPACE
Thomas Rosburg

9:20 Break

9:40 CONSERVATION ASSESSMENTS OF 6 IOWA STATE PRESERVES Part I
Wayne Schennum¹, and John Pearson²

10:00 CONSERVATION ASSESSMENTS OF 6 IOWA STATE PRESERVES Part II
Wayne Schennum¹, John Pearson²

10:20 Section Business Meeting
11:00 General Session III
12:00 ESTA Award Luncheon

Engineering Section
10:20-3:10, Bioscience & Health Science Building (BHS), Room 107

10:20 Section Business Meeting
11:00 General Session III
12:00 ESTA Award Luncheon
1:15 A DISTRIBUTED CONSENSUS BASED TECHNIQUE FOR OPTIMAL ECONOMIC DESIIPATCH IN SMART GRIDS
Raghuraman Mudumbai, Soura Dasgupta, and Muhammad Mahboob-Ur Rahman

1:35 EXPERIMENTAL STUDY OF GLOBAL AND LOCAL FLAME RESPONSE TO ACOUSTIC PERTURBATION AMPLITUDES
Jianan Zhang, K. Kaufman, and A. Ratner

1:55 PARAMETRIC STUDY OF BIOMASS GASIFICATION IN A PILOT-SCALE GASIFIER
Yunye Shi, Tejasvi Sharma, Guiyan Zhang, and Albert Ratner

2:15 Break
SECTION MEETINGS

See individual sections for room and schedule.

Engineering Section continued...

2:35  STOKER BOILER CFD MODELING IMPROVEMENTS THROUGH ALTERNATIVE HEAT EXCHANGER MODELING
      A.J. Depman, M. Ghamari, A. Ratner

2:55  NEW SCHOOL BUILDING AND ARCHITECTURE FOR SUSTAINABLE LIVING
      Andrea Wheeler, Naghmeh Pak, and Megan Fowler

Environmental Science & Health Section

8:20-10:40, Applied Science & Technology Building (AST), Room 103

8:20  DETERMINATION OF LC50 AND THE EFFECT OF TRICLOSAN EXPOSURE ON ZEBRAFISH HATCHLING MORPHOLOGY
      Mycaela Crouse, Amanda Kahl, Shannon Snyder, Rachel Spooner, Ellie Du Pre, and Nicole Palenske

8:40  PREVALENCE OF MULTI-DRUG RESISTANT BACTERIA IN NE IOWA STREAMS
      Anna Gudjonsdottir, Matthew Rosene, Rebekah Schulz, and Eric Baack

9:00  STUDY OF THE EFFECT OF URBAN LIFE IN THE WATER QUALITY OF THE RACOON AND DES MOINES RIVER WATERSHED
      Annie E. Stark, Alex Welsch, and Corbin J. Zea

9:20  Break

9:40  SPHINGOMONAS BREAKDOWN OF 17-BETA ESTRADIOL IN WASTEWATER TREATMENT
      Kayla Hartmann, Thom Bonagura, and Melinda Coogan

10:00 CAN LUNG FUNCTION BE ALTERED BY METOLACHLOR EXPOSURE? STUDY OF INFLAMMATORY CYTOKINE PRODUCTION IN HUMAN ALVEOLAR CELLS
      Hannah E. Wilson and Kavita R. Dhanwada

10:20  Section Business Meeting

10:40  Travel to General Session III

11:00  General Session III

12:00  ESTA Award Luncheon

Geology Section

9:40 -10:40, Bioscience & Health Science Building, Room 203

9:40  RECENT INSIGHTS INTO THE EVOLUTION OF THE MANSON IMPACT STRUCTURE, IOWA
      Raymond R. Anderson

10:00 ENGAGING UNDERGRADUATE STUDENTS IN GEOARCHAEOLOGY—EXPLORING SICILY AND IOWA
      Chad Heinzel, Victoria Arreola, John Chesley, and Erin Boyd

10:20  Section Business Meeting

10:40  Travel to General Session III

11:00  General Session III

12:00  ESTA Award Luncheon
SECTION MEETINGS

See individual sections for room and schedule.

Iowa Science Teaching Section
8:40-10:40, Bioscience & Health Science Building (BHS). Room 210

8:40 ISTS Section Meeting
9:40 Break
10:00 ENVIRONMENTAL ISSUES INSTRUCTION (EII), STEM AND NGSS: MULTIDISCIPLINARY TEACHING AND LEARNING K-12
   Barbara Ehlers¹, Julie Delaney², and Jeff Monteith³
10:20 Section Business Meeting
11:00 General Session III
12:00 ESTA Award Luncheon

Organismal Biology Section
9:20-10:40 Bioscience & Health Science Building (BHS). Room 207

9:20 TEMPORAL AND TEMPERATURE-BASED REPRODUCTIVE ISOLATION OF THREE GENETIC LENEAGES IN THE SUNFLOWER MAGGOT FLY, STRAUZIA LONGIPENNIS
   Jarod Armenta and Maren Elnes
9:40 RECOMBINATION RATES IN CHROMOSOME 5 OF DROSOPHILA AMERICANA: IS THERE EVIDENCE FOR NATURAL SELECTION?
   Rachel Connelly, Abigail Thomas, and Paulina Mena
10:00 DIVERSITY AND EFFECT OF ENDOHYTIC FUNGI ON IOWA PRAIRIE GRASSES
   Kimberly Howell and Eric J. Baack
10:20 Section Business Meeting
10:40 Travel to General Session III
11:00 General Session III
12:00 ESTA Awards Luncheon

Physics, Atmospheric & Space Science Section
8:40-10:40, Bioscience & Health Science Building (BHS). Room 209

8:40 COMPARING SUPER KAMIOKANDE ATTENUATION LENGTH TO PROPOSED HYPER KAMIOKANDE DETECTOR
   Karl James Ahrendsen¹, Chris Walter², Alex Himmel², and Tarek Aziri³
9:00 PERTURBATIONS TO THE NEUTRINO MIXING WITH COMPLEX PHASES
   Jiajun Liao¹, Danny Marfatia², and Kerry Whisnant¹
9:20 Break
9:40 NANO-PHOTONIC ORGANIC SOLAR CELL ARCHITECTURE FOR ADVANCED LIGHT TRAPPING WITH DUAL PHOTONIC CRYSTALS
   Akshit Peer and Rana Biswas
10:00 TRANSITION PROBABILITIES AND EQUATIONS OF MOTION OF OPERATORS
   Kuo-Ho Yang
10:20 Section Business Meeting
SECTION MEETINGS
See individual sections for room and schedule.

10:40  Travel to General Session III

Physics, Atmospheric & Space Science Section continued...
11:00  General Session III
12:00  ESTA Awards Luncheon

Physiology & Health Science Section
10:20-10:40, Bioscience & Health Science Building (BHS), Room 115
10:20  Section Business Meeting
10:40  Travel to General Session III
11:00  General Session III
12:00  ESTA Awards Luncheon

Thank you for attending the 126th Iowa Academy of Science Annual Meeting. We hope you enjoyed it.

Please plan to join us next year at the Iowa Memorial Union on the campus of The University of Iowa. April 17—18, 2015
Abstracts are listed by section with posters listed first and oral presentations listed second. Oral presentation abstracts are listed in the order of presentation. Abstracts submitted for a project which was funded in part by the Iowa Science Foundation are labeled with an ISF at the end of the abstract title. Abstracts supported by the Iowa Space Grant Consortium are labeled with an ISGC at the end of the abstract title.

Anthropology

Section

Poster Presentations

1. EXPLOITATION OF BIRDS BY LATE PREHISTORIC FORAGER-FARMERS ALONG THE CENTRAL DES MOINES RIVER

Amanda Bernemann
University of Iowa

Comprehensive analyses of bird remains from the Howard Goodhue Oneota site provide insight on the use of these animals by Late Prehistoric forager-farmers who lived along the Des Moines River in central Iowa. The collection of avifauna includes 614 specimens, with taxa ranging in size from small passerines to ducks, geese, turkey, and swan. They acted as a supplementary, and likely seasonal, food source in the varied diet of the Oneota. Additionally, modifications on the specimens indicate these animals were utilized as a source of raw material in the production of bone beads.

2. I-SITESGOV: EXPANDING ACCESS TO THE IOWA SITE FILE FOR PROJECT PLANNERS

John F. Doershuk, Mary De La Garza, and Colleen Eck

I-SitesGov is a newly available controlled-access GIS website that broadens access to the Iowa Site File (the database of recorded archaeological site locations in Iowa). Subscribers are federal, state, county, and local officials and consultants who do not meet the professional archaeological standards necessary to access I-SitesPro but who need an enhanced level of data for Cultural Resource Management (CRM) planning and consultation beyond what is accessible to the general public via I-SitesPublic. I-SitesGov provides users with map-based counts of recorded archaeological sites per quarter-section and includes a shapefile layer that illustrates areas previously subjected to archaeological investigation. These data counts and survey coverage serve as important compliments to the types of data available through additional sources and allow better informed and more specific decision-making about potential project effects. Additional data layers are planned, such as burial project information. Links to other data sources to add georeferenced layers like aerial photography, LiDAR, and soils will be incorporated to further assist in identifying and expediting the need for hiring professional CRM consultants and assisting federal agencies in completing their compliance reviews. The I-SitesGov portal includes live hyperlinks to referenced websites and an online tutorial.

3. FAR FROM HOME: USING 87Sr/86Sr ISOTOPE RATIOS TO UNDERSTAND MOBILITY PATTERNS IN LATE PREHISTORIC SPAIN

Matthew R. Purl1, Nicholas R. Wilson1, Anna J. Waterman1, Jonathan T. Thomas2, Pedro Diaz-del-Río3, and David W. Peate2

Mount Mercy University1; University of Iowa2; Instituto de Historia (CSIC), Spain3

In this research strontium isotope ratios (87Sr/86Sr) were measured in the dental enamel of 85 individuals interred at Chalcolithic and Bronze Age burial sites near Madrid, Spain. The
goal of this research was to identify nonlocals in these burials in order to understand migration patterns in late prehistoric Spain. Strontium isotopes are absorbed into the tissues of animals and plants through the soil and through water and food intake. Regional geologic variation can result in measurable differences in bioavailable strontium ratios in animals and plants. During childhood dental enamel is formed and, unlike bone, is not remodeled later in life. Therefore, the dental enamel preserves the 87Sr/86Sr ratio of a person’s childhood home. The results of this study found that only 4/85 (4.7%) of the sampled individuals exhibit non-local 87Sr/86Sr isotope ratios. This suggests that migration was not common in this region. Nonetheless as this methodology cannot identify individuals that may have moved from other places with similar geologic features, the number of migrants in this sample should only be interpreted as representing the minimum number of migrants. Based upon the 87Sr/86Sr ratios, all of the identified migrants came from regions with substantially older geologic features. Possible places of origin are being investigated.

4. ARCHAEOLOGEE: AN ENVIRONMENTAL EDUCATION PROGRAM FOR PUBLIC LANDS MANAGEMENT AGENCIES AND AMERICAN INDIAN SCHOOL CHILDREN
Elizabeth C. Reetz
University of Iowa Office of the State Archaeologist
Archaeology fieldwork can be viewed as a compelling method for delivering lessons in environmental education (EE), because cultural history is important to EE and archaeology looks through both natural and cultural lenses in an outdoor setting. In addition, ethnic minority communities including American Indians have traditionally been underserved by EE (Zint, 2012) and the perspectives of indigenous communities are often lacking from archaeological reporting. With that in mind, the ArchaeologEE program was developed to be a resource and guide for archaeologists in Cultural Resource Management (CRM) at public lands agencies, who typically do not have a background in education, in archaeology, and environmental education-based public outreach with indigenous youth in Grades 6-12. The intention of ArchaeologEE is two-fold. It aims to provide effective EE through archaeology to enrich the educational experiences of indigenous youth through time spent in nature. It also seeks to offer a way to enhance the professional development of archaeologists through a new approach to public outreach and increased engagement with local indigenous communities.

5. THEORETICAL ORIGINS OF PROJECTILE POINT TYPOLOGIES IN IOWA
Benjamin Shirar
Grinnell College
Typological classification is used by archaeologists as a means of determining chronology, cultural affiliation, and degrees of cultural contact. This paper explores theoretical underpinnings for this system, from Linnean taxonomy to Southwestern ceramic typologies, and the way this theoretical background has impacted our understanding of projectile point variation and its ramifications. ARCgis is used to model the distribution of various Iowa projectile point types and test assumptions about cultural transmission, stylistic variation, and the mutability of typologies.

6. A FIRE-CRACKED PUZZLE: TESTING THE EFFICACY OF XR-F SCANNING TO FACILITATE REFITTING
Luke Stroth
University of Iowa
Woodpecker Cave, a small rock shelter in Johnson County, was partially excavated in 1956. The record keeping of the mid-twentieth century was poor, and the unscreened back dirt was dumped on top of intact geological levels, inverting the stratigraphy of the site. A primary goal of the University of Iowa 2012 and 2013 archaeological field schools was to learn more about the deposition of the cave through modern excavation, recording, and analytical techniques. In 2012, much of the back dirt was removed, revealing a Late Woodland occupation (ca. 400-800 CE). The 2013 excavation expanded the area, revealing a hearth com-
posed primarily of fire-cracked rock, rock discolored and cracked by exposure to heat. The subject of my research is to try and refit fragments of the fire-cracked rock, in order to accomplish two goals: (a) use the three-dimensional spatial coordinates of the refit fragments to determine the integrity of the geological and cultural depositional units; and (b) showcase the use of an X-ray fluorescence gun as a refitting technique, and determine its efficacy. For the first question, if two fragments were found within the same proximity than that represents a more intact site, whereas if two fragments are found more distant than that represents a disturbed site. For the second question, the rocks were analyzed with the XR-F to determine chemical composition and grouped into like-mineralogical sets, which were then physically inspected in order to find refits.

7. SEARCHING FOR A NATION: SOUTH SUDANESE REFUGEES IN DES MOINES

Edgar Valles
Iowa State University

For my thesis, I explore how South Sudanese refugees in central Iowa imagine a utopic South Sudan amidst contemporary inter-ethnic tensions emanating from their recently independent country. I suggest not only that the ideal created in diaspora is rooted in transnational migration, re-interpreted identity and territory, but that the imagination then serves to circumvent the actions of the state, most importantly the state’s capacity to construct a unifying element for its people in Africa and abroad. In central Iowa, South Sudanese refugees subtly reproduce the type of unilateral authority they meant to leave behind, but instead of using tensions and divisions to further deepen ethnic divides, the diaspora enacts their own will through political discourse and community construction. Furthermore, I argue that South Sudan’s fragile ethnic dynamic, in modern South Sudan but also throughout the regions long history, necessitates re-defining the parameters of coexistence to encompass a nation that does not yet exist.


Mark L. Anderson and John F. Doershuk
University of Iowa

The Rummells-Maske Clovis site, 13CD15, is a nationally recognized archaeological site famous for the recovery of 21 Clovis projectile points, one blade tool, and several pieces of debitage. Wayne Rummells and Richard Maske discovered the site in 1964. Unfortunately, solid site location data was not clearly captured leaving some doubt as to the site’s exact placement on the landscape. Several events in 2011 conspired to afford an opportunity for the reexamination of the available data and to access the property in hopes of relocating the site. Archival finds at the Office of the State Archaeologist, field reconnaissance, a month-long field testing project, and a site visit with one of the original discoverers all lead to the successful relocation of this very important, and misrepresented archaeological site. This presentation provides an historical review of the Rummells-Maske Clovis point site, defines its true location, and sets the site in its proper archaeological context, all setting the stage for future research.

9. THE CARLISLE CLOVIS CACHE: LAND USE, TECHNOLOGICAL ORGANIZATION, AND FAUNAL EXPLOITATION IN THE MIDCONTINENT

Matthew G. Hill1, Thomas J. Loebel2, and David W. May3
Iowa State University1, Illinois State Archaeological Survey2, University of Northern Iowa3

Excavated from primary context in 1968, the Carlisle Cache represents one of only several contextually intact Clovis components in the Midcontinent. The cache is a collection of utilitarian gear, including 25 bifaces and 12 large flake-blanks made on Burlington chert that was stockpiled to
back future bison hunting, butchering, and hide processing activities in the central Des Moines River Valley. Though it was designed to satisfy the anticipated, task-specific needs of both men and women, the raison d'être for the cache's contents was not executed. In preparing for extended forays away from prime tool stone sources, greater emphasis was placed on gearing up weaponry components than on butchery and hide-processing tools, in anticipation of a relatively higher rate of point turn-over due to damage or loss in hunting. While the bifaces could have served as a source of small flakes for expedient tools, they are far too small to have served efficiently as bifacial cores. Instead, bifaces and large flake-blanks were made from tabular cores at the tool stone source, with intentions of future conversion into weapon tips and unifacial tools, respectively. This two-fold system of biface and flake production enabled Clovis foragers to prosper off-quarry no matter whether spoor steered them into mapped or unmapped areas. Technological and subsistence confidence was managed by performing early interval biface work at quarry sources, thereby decreasing the chances of off-quarry, late interval (point) manufacturing failures, and by regularly carrying substantial numbers of point and unifacial tool preforms. Such items were occasionally cached in areas where tool kits were prone to rapid depletion based on a history there of kill-butchery events, as well as at previously unvisited locations judged to have good potential for similar activities during anticipated future movements.

10. TEST EXCAVATION OF TWO PREHISTORIC JASPER COUNTY SITES: 2,700 FT IN SPACE SEPARATING 7,200 YEARS IN TIME.

Mark L. Anderson
University of Iowa

During the late fall and early winter of 2012, Phase I archaeological investigations were conducted along a highway reconstruction project in northwest Jasper County. Forty-four historic and prehistoric sites were examined including thirty-six newly recorded sites. Thirteen of these sites were determined to contain potentially intact deposits and nine were scheduled for Phase II testing in the summer of 2013. Two of these sites, 13JP230 and 13JP239, were of particular note as they occupy potentially undisturbed locations on the Bemis end moraine, with roughly 2,700 ft between them. Test excavations conducted during July not only indicated that these two sites were indeed undisturbed, but that they both contained significant deposits of a unique character, diagnostic artifacts defining specific cultural affiliations, and the probability of being single component occupations, both with roughly 7,200 years between them.

11. THE HUNGER GAMES: BOURGEOIS VersUS THE PROLETARIAT: AMERICA'S SOCIETY IS STRIKINGLY SIMILAR TO THE SCIENCE FICTION WORLD OF PANEM

Mary Nutter
The University of Dubuque

The purpose of this article was to take the science fiction world of Panem (a world created in the book "The Hunger Games" by Suzanne Collins) and compare it sociologically to our society. I discuss three sociological issues that can be prominently found in both Panem and America's society. These issues are: Government legitimacy, the use of propaganda, and food control. Throughout my research my eyes were opened. My goal went from writing a college course paper, to realizing that our government is slowly becoming one in the same with Panem's government. I hope that through the publication of this article, more people will begin to take notice of the things that I found in my research, and realize that it's time to take our society back.
12. THE ANTIMICROBIAL EFFECT OF BORIC ACID ON TRICHOMONAS VAGINALIS
Andrew Brittingham and Wayne A. Wilson
Des Moines University

Trichomoniasis, caused by *Trichomonas vaginalis*, is one of the most common non-viral sexually transmitted diseases world-wide, with an estimated 250 million cases occurring annually. In the United States, a single drug class, 5-nitroimidazoles, is currently relied upon in the treatment of trichomoniasis. There are numerous case reports of infections that are refractory to treatment with nitroimidazoles, and larger studies suggest that low-level metronidazole resistance is present throughout the United States. Although rare, immediate hypersensitivity reactions to 5-nitroimidazoles have also been reported, requiring either patient desensitization or alternative approaches to therapy to be implemented. Recently, intravaginally administered boric acid has been reported to be successful in the treatment of trichomoniasis in cases non-responsive to metronidazole, and in a case of nitroimidazole allergy. However, the exact mechanism by which boric acid contributes to clinical cure remains unknown. Here, we report that in vitro, boric acid is microbicidal to *T. vaginalis*, and that its antitrichomonal activity is independent of environmental acidification. Unlike, acetic acid and lactic acid, boric acid treatment results in growth suppression and lethality over a wide range of pH (5-7), and under conditions which are normally permissible for growth in vitro. Its direct microbicidal effect on *T. vaginalis*, coupled with its previous clinical use in treating bacterial vaginosis and candidiasis, support the continued inclusion of boric acid in the therapeutic arsenal for treating trichomoniasis.

13. THE TELOMERASE INHIBITOR MST-312 HAS AN ANTIVIRAL EFFECT ON HERPES SIMPLEX VIRUS
Phonphanh Dedthanou, Prajakta Pradhan, and Marie L. Nguyen
Des Moines University

Herpes simplex virus (HSV) is a double stranded DNA virus that causes cold sores and genital herpes. In between outbreaks, the virus remains latent in neuronal cells. Although there are effective treatment options available for HSV disease, antiviral resistance can occur. Therefore, there is a need to identify new antiviral targets. One novel approach to combat HSV-1 infection would be to target the cellular enzymes necessary for replication. One such target may be the cellular enzyme telomerase. Telomerase is the enzyme that prevents the shortening of telomeres. Previous research has shown that telomerase activity is increased during HSV infection. Our lab has recently determined that treatment with the telomerase inhibitor MST-312 dramatically reduced HSV replication when added to the infected cells prior to 6 hpi. The goals of this study were to characterize the effects of MST-312 on cell viability and virion stability. Trypan blue exclusion was used to measure cell toxicity in HEp-2 and hTERT-HME1 cells treated for 24 hours with 2-100 µM of MST-312. There was no statistically significant increase in cell death when MST-312 treated cells were compared to DMSO control. To determine the effects of MST-312 on HSV virions, HSV was treated with up to 100 mM of MST-312 for 90 minutes or less. The MST-312 in the samples of HSV was then diluted to a concentration below the lowest dose shown to affect HSV-infected cells; and infectious virus was measured using plaque assay on VERO cells. The greatest effect on plaque formation (95% inhibition) was observed in virions treated for 90 minutes at 100 µM MST-312 treatment. We conclude that MST-312 can have a direct antiviral effect on HSV.

14. PURIFICATION AND CHARACTERIZATION OF A β-FRUCTOFURANOSIDASE FROM THE PARASITIC PROTIST TRICHOMONAS VAGINALIS
Michael Dirkx, Michael P. Boyer, Andrew Brittingham, and Wayne A. Wilson
Des Moines University

*Trichomonas vaginalis*, a flagellated protozoan, is the agent responsible for trichomoniasis, the most common nonviral sexually transmitted infection worldwide. A reported 200 million cases are documented each year with far more cases going unreported. However, *T. vaginalis* is disproportionally studied, especially considering its basic metabolism. It has been demonstrated that *T. vaginalis* does not grow on sucrose. However, the *T. vaginalis* genome contains some eleven putative sucrose transporters and a putative β-fructofuranosidase (invertase). Thus, the machinery for both uptake and cleavage of sucrose appears to be present. We amplified the β-fructofuranosidase from *T. vaginalis* cDNA and cloned it into an *Escherichia coli* expression system. The expressed, purified protein was found to behave similarly to other known β-fructofuranosidases. It had a similar $K_m$ and $V_{max}$ to previously characterized enzymes using sucrose as a substrate, was also active towards raffinose, but had no detectable activity towards inulin. Thus, *T. vaginalis* has the coding capacity to produce an active β-fructofuranosidase capable of hydrolyzing di- and trisaccharides containing a terminal, non-reducing fructose residue. Since we cloned this enzyme from cDNA, we know that the gene in question is transcribed. Furthermore, we could detect β-fructofuranosidase activity in *T. vaginalis* cell lysates. Therefore, the inability of the organism to utilize sucrose as a carbon source cannot be explained by an inability to degrade sucrose.

15. IS MRSA AMONG US?
Megan Feuchtenberger, Laura Hurley, Emily Nienhuis, Kelley Hurley, Elizabeth Heeg, and Todd Tracy
Northwestern College

Methicillin-resistant *Staphylococcus aureus* (MRSA) is a form of antibiotic-resistant bacteria that is easily spread and can be deadly. Because of these characteristics, the presence of MRSA in weight rooms and athletic facilities is of concern.

We wanted to determine if MRSA was among the bacteria present in our exercise facility at Northwestern College, Orange City, Iowa. To identify the high traffic areas in the facility, we sampled sixteen locations and were able to identify four areas that had the highest amount of bacteria growth. We then cultured samples from these locations before and after cleaning to examine the presence of bacteria and the efficacy of the current cleaning protocol at the facility. We used mannitol plate selection and Kirby-Bauer disk diffusion susceptibility tests to determine whether MRSA was present among these cultures.

16. EFFECTS OF BLOODROOT (*SANGUINARIA CANADENSIS*) ON THE HUMAN PATHOGENIC FUNGUS *CANDIDA ALBICANS*
Austin T. Granatowicz, Samuel W. Shelton, Carter M. Tegeler, Aaron A. Brown, and Tammy d’Artenay
Morningside College

*Candida albicans*, a human pathogenic fungus that causes oral and genital infections, was treated with sanguinarine, chelerythrine, and propine, all alkaloids with known antibacterial properties. These alkaloids were isolated from the roots of *Sanguinaria canadensis*, commonly known as bloodroot, a perennial flowering plant found in eastern North America. *S. canadensis* is a known medicinal plant and has been used for hundreds of years as both an antibacterial and topical treatment for skin ailments. A serial dilution was used to create multiple concentrations of the three alkaloids as well as the entire plant. These concentrations were examined using a zone of inhibition test in order to determine their fungicidal nature.

17. BORIC ACID HAS STRONGER INHIBITORY ACTIVITY ON THE HYPHAL THAN ON THE YEAST FORM OF THE DIMORPHIC FUNGUS *CANDIDA ALBICANS*
Alexander J. Hjelmaas¹, Celia S. Venezia², Michael P. Boyer³, and Martin Schmidt³
University of Iowa¹, Drake University², Des Moines University³

The opportunistic pathogenic fungus *Candida albici-
cans is able to transition from a unicellular yeast to a multicellular, hyphal morphology. This morphological transition is a major virulence factor for *C. albicans* and mutants locked in the yeast state have no infective potential in rodent models. Boric acid (BA) is a broad spectrum antiseptic component that has shown to be effective against vaginal yeast infections. Since BA prevents the formation of *C. albicans* hyphae in vitro, we hypothesize that the antifungal properties of BA result from its ability to suppress the yeast-to-hyphae transition in *C. albicans*. In order to learn about the physiological and morphological effects of BA on *C. albicans*, we screened a deletion library for mutant strains with abnormal BA resistance. The screening succeeded in isolating 27 BA sensitive and 7 BA resistant mutants. The morphological phenotypes of the mutants were strongly correlated with their BA resistance: Mutants with constitutive hyphal growth phenotypes (sko1, tup1, nrg1 and rbf1) showed BA sensitivity whereas mutants that could not initiate hyphal growth (efg1, rim9, rim13 and rim101) presented as BA resistant. We conclude that BA has a stronger inhibitory effect on the hyphal than on the yeast form of *C. albicans*.

18. COMPLEMENT COMPONENT C1Q REGULATES MACROPHAGE INFLAMMATORY SIGNALING

Sean D. O'Conner, Holly Hulsebus, and Suzanne S. Bohlson
Des Moines University

Efficient clearance of apoptotic cells and dampening of proinflammatory cytokine production is required for prevention of autoimmunity. Deficiencies in complement component C1q are associated with a failure to clear apoptotic cells and autoimmunity, and we are investigating the mechanism by which C1q regulates these functions in macrophages. We recently demonstrated that C1q up-regulates expression of Mer tyrosine kinase (TK), a receptor on the membrane of macrophages that mediates apoptotic cell clearance and anti-inflammatory signaling. The goal of this study is to investigate the contribution of C1q-dependent alteration in gene expression, including MerTK, to anti-inflammatory signaling. To measure inflammatory signaling, we stimulated mouse bone marrow-derived macrophages (BMDM) with lipopolysaccharide (LPS), an inflammatory trigger, and measured tumor necrosis factor-alpha (TNF-α) production by ELISA. BMDM were adhered to C1q or a control protein (human serum albumin, HSA) for 30 minutes or 18 hours prior to stimulation with LPS. Under these conditions, MerTK was up-regulated at 18 hours but not 30 minutes. BMDM adhered to HSA or C1q for 30 minutes produced 3301.4 pg/ml and 2871.3 pg/ml TNF-α, respectively and there was no significant difference between samples (n = 3, p > 0.05). However, at the 18 hour time point, we found the TNF-α produced by C1q-stimulated BMDM was 703.2 pg/mL compared to 2026.8 pg/ml in the HSA control group (n = 3, p < 0.05). This time dependent decrease in TNF-α suggests that C1q produces anti-inflammatory effects through a change in gene transcription. Our goal for future studies is to focus more on this aspect of anti-inflammatory signaling and determine if MerTK is important for this signaling pathway.

19. TRANSFORMATION OF SPECIES FROM FIVE BIOLOGICAL KINGDOMS USING AEROSOL BEAM INJECTION AND PARTICLE BOMBARDMENT

Jena Peters and James Hampton
Buena Vista University

Since Stine Biotechnology patented the ABI in 1993, Dr. Bruce Held has proven the device to be useful for agricultural purposes. Roundup corn is an example of the value of the ABI. Roundup corn was modified using the ABI to induce the corn to be resistant to glyphosate, an herbicide largely used to kill weeds. With resistance to the herbicide, the growth of the corn will not be affected and glyphosate can still be used as an effective herbicide. This technology has also been used to produce Roundup Ready soybeans and other seeds that have been proven to be very valuable to the agriculture industry. Since its invention, research involving the ABI has been limited to the transformation of bacteria, plants, and protists. The purpose of this project was to extend the use of the ABI to all five kingdoms of the biological world. Yeast and HeLa cells were included in the experiment along with bacteria, protists, and
20. IDENTIFICATION OF CANDIDATE IRON DEPENDENT PROTEIN REGULATORS OF CANONICAL WNT SIGNALING

Kaylee Vitale¹, Jenna Brewer¹, Ivana Mihalek², and Gary Coombs¹
Waldorf College¹, Bioinformatics Institute, A*Star, Singapore²

Intracellular iron is an essential positive regulator of Wnt signaling. Iron chelation inhibits signal response even in the presence of stabilized mutants of β-catenin. The activity of an iron dependent enzyme or enzymes in β-catenin mediated, Wnt responsive transcription is therefore implicated, but its/their identity is unknown. We present several bioinformatics approaches to identifying candidate iron dependent enzymes. We have obtained data from RNAi based primary screens performed in three separate labs aimed at identifying all canonical Wnt regulatory proteins in several human and Drosophila cell lines. A Venn diagram of the 3 datasets using Entrez gene IDs revealed concordance of ≤1.4% between any 2 datasets. We then automated a search for proteins identified in these papers as positive regulators that were described as iron binders in the gene ontology database. This yielded a small pool of candidates. As an alternative method, we cross-referenced all iron-binding proteins identified in the gene ontology database with proteins identified in Biogrid as either direct or indirect physical interactors with β-catenin. This approach yielded 50 candidates, 9 of which are identified as positive regulators in at least one of the published RNAi studies. We are currently conducting literature and structure-based evaluations of each of these 9 candidates to develop models that could provide a mechanism whereby they would affect signaling. Two promising candidates are DGRC8, and a family of related lysine demethylases. The lysine demethylases are known to regulate other transcriptional signal responses via epigenetic effects. DGRC8 catalyzes an initial step in miRNA processing, and at least three miRNAs have now been shown to positively regulate Wnt signaling.

21. IN-VITRO EFFECTS OF MLCN2 EXPRESSION

Michael Zeller, Ilchung Shin, Lee Bendickson, and Marit Nilsen-Hamilton
Iowa State University

During the proliferation phase of wound healing, epithelial cells must both divide and migrate to generate new tissue to replace the fibrin clot. The expression of the mLcn2 gene has been shown to begin in this phase with increased expression continuing at least 72 hours after wounding. Studies of three mouse endothelial cell lines provided evidence that mLcn2 influences the division and migration rate of endothelial cells. In growth assays, the cells were quantified by using a Coulter Counter. An endothelial cell line modified to overexpress mLcn2 was found to divide at a faster rate than the wild-type and Lcn2 knock-out (no mLcn2 gene) cell lines. The cells that overexpress mLcn2 also migrated faster than either their wild-type or mLcn2 knockout counterparts as quantified using the T-scratch assay.
green fluorescent protein (eGFP) gene to the matrix gene resulting in a matrix-eGFP fusion protein. Plasmids which contain either the HA, NA and M (fused to GFP) genes in a mammalian expression vector have been generated. Using these plasmids in transfections of 293T cells, current experiments are aimed at producing particles of the circulating H3N2 and H1N1 subtypes. In addition, using this system the effects of specific mutations in the N2 neuraminidase and the abnormal combinations of H3N1 and H1N2 are being used to produce VLPs to examine the effects that these changes in neuraminidase have in particle formation and particle binding. Data presented will include evidence for formation of these VLPs 48 hours post transfection and the effects that mutations or changes in HA NA combinations have on particle formation.

23. EFFECTIVENESS OF ETHANOL-BASED HAND SANITIZER EXPOSED TO VARIOUS ENVIRONMENTAL CONDITIONS

Anna Cleland-Leighton and Mary Shawgo
Graceland University

The use of ethanol-based hand sanitizers by individuals and health care providers to help prevent the spread of infectious diseases is on the rise. It is important to identify conditions that could compromise the effectiveness of the ethanol-based sanitizer. The goal of the project is to determine the effectiveness of ethanol-based hand sanitizers that were exposed to UV light, exposed to temperatures of 37 °C, or -20 °C. A modified zone of inhibition test was used to evaluate effectiveness of the treated and untreated hand sanitizers against the following lab strains: Escherichia coli, Staphylococcus epidermidis, and Pseudomonas aeruginosa. Additionally, bacterial samples were taken from participants' hand before and after application of the treated or untreated hand sanitizers. Optical density of samples incubated in Muller-Hinton broth was determined. A comparison of optical density from treated and untreated samples will be used to determine the effectiveness of the different hand sanitizers. Preliminary results indicate that heating to temperatures of 37 °C decreases the effectiveness of ethanol-based hand sanitizers.

24. GENETIC ANALYSIS OF PUTATIVE CELL DIVISION GENES IN ESCHERICHIA COLI

Jeremy Cline\(^1\), Ryan Bezy\(^1\), and David Weiss\(^2\)
Mount Mercy University\(^1\), University of Iowa\(^2\)

Cell division in bacteria is mediated by a complex of proteins known as the septal ring, with approximately 10 of these proteins being essential for cell division. Removal of proteins essential to division results in a filamentous phenotype. Many other proteins aide in modulating cell division, but are not vital to the process and typically do not show a strong phenotype when deleted. In order to find additional essential and nonessential proteins involved in Escherichia coli a suppression screen in a \(\DeltaftsEX\) background was carried out. \(\DeltaftsEX\) is essential for cell division under high temperature and low salt conditions; when removed the cells become filamentous as a result of failure to properly divide. The mutant screen revealed several genes that were possible multi-copy suppressors of \(\DeltaftsEX\). Individual genes were then cloned into an expression vector and transformed into the \(\DeltaftsEX\) background to determine if a single gene could suppress the mutant phenotype. One such gene, yedR, showed suppression of the \(\DeltaftsEX\) phenotype was selected for further study. Green fluorescent protein was attached to the N-terminus and C-terminus of YedR to determine its cellular localization during division. C-terminal YedR:GFP fusions showed localization to the septal ring, while N-terminal YedR:GFP fusions did not. Deletion of the yedR gene from WT Escherichia coli did not produce a filamentous phenotype. Taken together this indicates that YedR is most likely a nonessential protein involved in the bacterial cell division, and that it's N-terminus is important for interaction with other components of the septal ring.

25. THE ROLE OF TCP GENES IN GROWTH AND DEVELOPMENT OF ORCHIDS

Lauren T Smith, Tyson J Carter, and Rasika G. Mudalige-Jayawickrama
University of Dubuque

Plant growth and development is controlled by many regulatory genes known as transcription fac-
tors. One such regulatory gene family, the TCP family, play a crucial role in determining the plant architecture, lateral organ development including leaf curvature, petal growth, stamen suppression, floral symmetry and floral organ identity. Isolation of all TCP genes from the orchid family and analysis of their expression profile is the first step towards understanding how these key regulators contribute to the enormous morphological diversity and evolution of the largest flowering plant family. We isolated six new TCP genes from the orchid floral and vegetative buds and determined their expression pattern in order to understand their function in vegetative and reproductive development. All TCP genes are expressed in actively dividing or differentiating tissues which suggests their possible role in growth and development. The TCP family is divided into several clades; CINCINNATA, TB1 (Teosinte Branched-I)/CYCLOIDEA, and PCF1. Genes that belong to CINCINNATA clade is mostly expressed in floral tissues while the only gene of TB1 clade is expressed in vegetative buds. PCF clade is expressed in all actively dividing tissues. Previously, we have isolated two TCP genes, Den-TCP-1 and Den-TCP-2, similar to CINCINNATA gene of Antirrhinum. Their sequence analyses revealed a binding domain for the microRNA known as miR319. We determined the expression profile of the Den-TCP-1 and Den-TCP-2 in floral organs of different stages. Their expression patterns show an inverse relationship to that of miR319. Ventral organs tend to have a lower expression of TCP with higher miR319 expression. We will discuss the regulatory role of miR319 mediated TCP gene regulation in floral organ identity in Dendrobium.

26. DELINEATING THE ROLE OF MIR319 MEDIATED TCP GENE REGULATION IN ORCHID FLORAL DEVELOPMENT
Tyson J Carter1, Lauren T Smith1, Rasika G. Mudalige-Jayawickrama1, Marek Sliwinski2, and Tere-sita D Amore3
University of Dubuque1, Marek Sliwinski2, University of Hawaii at Manoa3
The discovery of microRNA has added a new layer of gene regulation into the biological world. microRNA mediated gene regulation is involved in every aspect of plant development including flower development. There are several known miRNA molecules involved in floral development: miR156, miR159, miR167, miR172 and miR319 being the most predominant ones. Our previous research identified two key regulatory genes (TCP genes) with conserved miR319 binding sites. The main focus of our research was to find the microRNA profile of Dendrobium orchid floral buds and to find the expression pattern of the major regulatory microRNAs of flower development. We have successfully constructed a miRNA derived small cDNA library and analyzed their sequences by comparing them to known miRNA databases. Our results indicate most of the common floral miRNAs found in dicot model plant (Arabidopsis) is also found in orchid floral buds. However we found many small RNA species that are not represented in other databases. Since orchid genome has not been fully sequenced it is difficult to find the probable target genes regulated by these new small RNA species. We also complemented our study on TCP transcription factors by finding out that miR319 expression profiles are inversely related to those of Dendrobium TCP genes, Den-TCP-1 and Den-TCP-2. These results suggest miR319 play a crucial role in regulating the expression of florally expressed TCP genes. The apparent dorsoventral gradient of TCP genes appears to be a result of the post transcriptional regulation of TCP genes mediated by miR319. We also determined the miR319 profile of a mutant Dendrobium in which the characteristic orchid lip (modified dorsal petal) has been reverted back to a normal petal. Comparative miR319 expression profiles of parental and F2 segregating lines of these mutant plants suggest miR319 mediated TCP gene regulation may play a crucial role in petal/lip identity, stamen suppression, and floral symmetry in orchids.

27. DISCOVERING CANDIDATE GENES CAUSING GLAUCOMA BY IDENTIFYING PROTEINS THAT INTERACT WITH SH3PXD2B USING A YEAST TWO-HYBRID SCREEN
James Estipona1, Kacie Meyers2, Michael G. Anderson2, and Alesia Hruska-Hageman1
Mount Mercy University1, University of Iowa2
Glaucoma is one of the leading causes of blindness
throughout the world and affects approximately 60 million people worldwide. The nee Mice, with a mutation in the SH3PX2D2B gene, develop an early onset form of glaucoma. This gene is linked to Frank-Ter Haar syndrome in humans, a rare disease resulting in congenital glaucoma, cardiac, skeletal, and craniofacial abnormalities. SH3PX2D2B is composed of: an N-terminal PX domain, four SH3 domains, multiple PXXP motifs, and several tyrosine phosphorylation sites. Many of these domains are possible binding sites for protein-protein interaction. SH3PX2D2B is thought to be a podosomal adaptor protein interacting with membrane spanning metalloproteinases that aid in adhesion, degradation, and remodeling of the extracellular matrix. Immunolocalization studies identified SH3PX2D2B distribution in multiple tissues in the eyes including the trabecular meshwork, an extracellular-rich filter for the outflow of aqueous humor. Defects in this meshwork can cause elevated intraocular pressure, a risk factor and the only clinically treatable feature of glaucoma. The mutant SH3PX2D2B gene in nee mice consists of a 1bp deletion that leads to truncation of the third SH3 domain and deletion of the fourth SH3 domain of the protein. Since nee mice develop early onset glaucoma, understanding what proteins bind to the third and fourth SH3 domain of SH3PX2D2B may identify other proteins involved in the molecular mechanisms that cause glaucoma, and help us better understand the function and regulation of the SH3PX2D2B protein in podosomes. To identify these proteins, a yeast-two hybrid screen was performed using the third SH3 domain as bait. Prey plasmids encoding 50 distinct proteins from a normalized mouse library were identified and are being tested to determine which are specific for the SH3 domain of the bait protein.

28. CHARACTERIZATION OF A NOVEL C1Q-DEPENDENT ENGULFMENT PATHWAY IN PRIMARY MOUSE AND HUMAN PHAGOCYTES
Holly Hulsebus and Suzanne S. Bohlson
Des Moines University

Complement component C1q is an effector molecule of the innate immune system, and it has a well described role in enhancing phagocytic function of monocytes, macrophages, and dendritic cells independent of complement activation. Deficiency in C1q leads to the development of autoimmunity due to decreased ability to engulf apoptotic cells (efferocytosis), however the mechanism leading to C1q-dependent efferocytosis is poorly understood. C1q consists of a C-terminal globular head region and an N-terminal collagen-like tail (C1q-tails). Previous studies have implicated the C1q-tails in enhancement of phagocytic function of antibody opsonized erythrocytes (EA IgG), complement opsonized erythrocytes, and apoptotic cells. Our lab recently identified a novel mechanism for C1q-dependent enhanced efferocytosis in mouse macrophages: C1q upregulates expression of Mer tyrosine kinase (MerTK) and its ligand, Gas6, a well-known receptor-ligand pair required for efferocytosis. Interestingly, the C1q-tails were not sufficient to elicit MerTK expression despite their ability to trigger engulfment of EA IgG. Accordingly, only full length C1q, and not the C1q-tails, were sufficient to trigger MerTK dependent efferocytosis. In order to translate these findings into a more clinically relevant cell population, human monocytes were purified and differentiated into macrophages using 20% AB+ human serum. While human monocytes responded to C1q with enhanced engulfment of EA IgG, they failed to respond to C1q with enhanced efferocytosis. In contrast, human macrophages from two separate donors responded to C1q with enhanced engulfment of EA IgG and enhanced efferocytosis. These data further define a novel pathway leading to C1q-dependent efferocytosis and provide evidence that the pathway is conserved in human macrophages. Future goals involve continued investigation of the molecular mechanism leading to C1q-dependent efferocytosis, and identification of the significance of this novel engulfment pathway in lupus.

29. EFFECTS OF A LOW GRAVITY ENVIRONMENT ON CULTURES OF A549 CELLS
Alexis Balgeman and Marc Busch
Drake University

As mankind ventures into long term space travel and extended periods of time in space, it is im-
important to understand how low gravity environments may affect pathogen replication. Cell culture is an invaluable research tool in understanding the replication of many intra-cellular pathogens, especially viruses like influenza. Adherent, submerged monolayers of A549 cells (a lung carcinoma cell line) have been one of the standard cell lines used for studying various stages of influenza virus replication. By utilizing a rotating wall vessel system, which places cells under continuous free fall, a low gravity environment can be generated allowing for the examination of the effects low gravity environments may have on influenza replication either as a result of expression of genes associated with the host cell innate immune response or through host protein-viral protein interactions. Data presented will include bright field microscopy images demonstrating the kinetics of formation of three dimensional cell structures. Additionally, using a GFP reporter construct and fluorescent microscopy the ability to transf ect these cells grown in low gravity will be presented. Currently, using immunocytochemistry, the cytoskeletal structures of normal gravity and low gravity cultured cells are being examined and using microarray analysis, changes in gene expression, particularly those involved in innate immune responses are also being determined. As research furthering our understanding of the effects of space exploration on cellular gene expression and how that may alter pathogen, particularly viral, replication is pursued, the establishment and understanding of these low gravity cultures will be an important model system.

30. BORIC ACID INHIBITS HYPHAL GROWTH OF C. ALBICANS BY PREVENTING SPITZENKOERPER MAINTENANCE
Benjamin R. Pointer, Michael P. Boyer, and Martin Schmidt
Des Moines University
The yeast Candida albicans is a ubiquitous commensal organism of human mucosal epithelia. However, in response to environmental stimuli such as elevated temperature or neutral pH, C. albicans transitions from a unicellular yeast to a multicellular hyphal morphology. This transition converts C. albicans to a pathogen, allowing it to penetrate epithelial layers and to colonize the human host. Since the ability to induce hyphal growth is considered a major C. albicans virulence factor, suppression of hypha formation is emerging as a novel strategy for the control of C. albicans. Boric acid (BA) has been shown to be very effective in the treatment of Candida vaginitis, presumably by suppressing the formation of invasive hyphae. We hypothesize that the presence of BA inhibits the growth of C. albicans hyphae. In order to characterize the effects of BA on the growth of C. albicans hyphae, we imaged the secretory organelle at the hyphal tip (the Spitzenkoerper) with the help of a GFP-tagged marker protein and the lipophilic dye FM4-64. We found that within minutes of exposure to non-lethal concentrations of BA, the Spitzenkoerper disappear from C. albicans hyphal tips, indicative of a cytoskeletal dysfunction that impairs hyphal growth. The inhibitory effect of BA on Spitzenkoerper maintenance was freely reversible and the organelles reappeared minutes after BA was washed out of the culture medium. We conclude that BA has a transient inhibitory effect on the secretory apparatus of C. albicans hyphae that may explain BA suppression of C. albicans invasive growth.

31. SYNTHESIS OF THIOL PHOSPHONAMIDATE ANALOGS
Michael Brus, Jennifer Fulton, and Stephen Sieck
Grinnell College
We have reported a synthesis utilizing ring-closing metathesis (RCM) to form seven-membered heterocycles containing sulfur, nitrogen, and phosphorous, known as a thiol phosphonamidate. Herein we report an optimized methodology, using amino acid precursor to diversify these heterocycles. Our progress using two amino acid derivative routes will be presented. The first route utilizes valine...
and leucine to externally diversify the heterocycle at nitrogen. The second route provides diversification within the heterocycle by utilizing substituted allyl amines produced via Wittig chemistry. We have utilized these synthetic strategies to produce a library of heterocycles to access their potential biologically activity.

32. GAS-PHASE HYDROGEN DEUTERIUM (H/D) EXCHANGE OF PROTONATED AND ALKALI-METALATED HISTIDINE-CONTAINING DIPEPTIDES
Bao Ying Chen, Elizabeth Phelan, Max Calenberg, and Elaine Marzluff
Grinnell College

Characterization of the gas-phase structure of proteins is important in understanding the degree to which water and metals play a role in determining the three-dimensional structure of proteins. Our research focuses on understanding the gas-phase hydrogen/deuterium (H/D) exchange of simple peptide systems, as studying simple biological systems is necessary for complete analysis of proteins. We utilize electrospray ionization-ion trap mass spectrometry (ESI-ITMS), a technique that allows for volatilization of large biological molecules, to study the H/D exchange of protonated and alkali-metalated Gly-His and His-Gly dipeptides. We observe alkali-metalated Gly-His dipeptide exchanged fewer hydrogens when compared to protonated Gly-His. Similar preliminary results were observed for metalated and protonated His-Gly. Further investigation into the observed difference in exchange rate between metalated and protonated forms of Gly-His and His-Gly using computational studies will be presented. Understanding the structural changes of small histidine containing peptides in the gas-phase can help us better understand the effects of water and metals on a protein’s three dimensional structure.

33. EFFECT OF MOISTURE ON THE CRYSTALLINE STRUCTURE OF PURE MONOGLYCERIDES
Hannah Stonewall and Abebe Mengesha
Drake University

The phase behavior of amphiphilic lipids and surfactants at various relative humidity levels and water content is of great interest for many technical and pharmaceutical applications. Monoglycerides, such as glyceryl monolaurate (GML) and glyceryl monostearate (GMS), are self-assembling amphiphilic molecules that form a variety of crystalline structures with useful mechanical properties of special interest in drug delivery. Lipid matrices containing mixtures of GML and GMS have been evaluated for their potential application as magnetically induced thermo-responsive local drug delivery systems. The presence of excess moisture or hydrophilic additives such as ethanol, PG, and PEG 400 are reported to influence the phase behavior of monoglycerides and induce conversion of crystalline arrangement into a low melting point polymorph that releases the drug faster. The aim of this study was to investigate the effect of moisture on the crystal behavior of GML and GMS. GML and GMS were stored at 75% and 97% relative humidity chambers for a period of 1 week. NaCl and K2SO4 saturated solutions were used to create the 75% and 97% RH, respectively. At the end of the experiment period, the gain or loss of weight as well as the melting points, relaxation temperature, and heat of fusion were determined. The thermal properties were evaluated using differential scanning calorimetry (DSC). The results of the study indicate that the weight of GMS was increased by 2.5 (±0.2) wt. % at 97% RH, whereas GML gained only 0.1 wt. % at the same RH level. GML stored at 75% RH showed a loss of weight (0.19 wt. %). The DSC thermogram of GMS showed an endothermic melting point peak at 74.71 °C. Upon exposure to 97% RH for 1 week, the melting point was shifted to 73.3 (±0.58) °C, which is in agreement with the 2.5% water gain. On the contrary, GML samples stored at RH of 75% showed an increase in melting point to 66.0 (±0.2) °C. The melting point of GML is 64.88 °C. The loss of water from the GML at 75% RH might be a contributing factor for the higher melting point. Based on the above result, it can be concluded that the crystalline structure of both GML and GMS is not significantly affected by moisture.
34. OPTIMIZING THE PRODUCTION OF BIODIESEL FROM FREE FATTY ACIDS EXCRETED FROM CYANOBACTERIA
Allison L Roe and Joseph G. Nguyen
Mount Mercy University
Biodiesel is an alternative diesel fuel that can be produced from a variety of renewable sources, such as plant oils, fats, recycled grease, and even algae. An extremely attractive approach is to produce biodiesel from free fatty acids (FFA) excreted from cyanobacteria. This approach is advantageous to biofuel production because there is less processing involved with the isolation of FFA. A strain of cyanobacteria has been successfully genetically modified to secrete FFA in culture one hundred times more than the wild type strain. In order to determine the feasibility of utilizing these secretions for the production of biodiesel, it is essential to optimize the conditions for esterification of FFA. The presentation will discuss the efforts made towards optimizing the esterification of FFA, including yield and conversion.

35. AN ANALYSIS OF THE THERMOPHILIC MECHANISM OF POTATO TYROSINASE
Melissa Englert, Mitchell Goff, Maria Mondragon, Chelsea Olson, Kayla Olson, and Mark Sinton
University of Dubuque
Tyrosinase, also known as polyphenyl oxidase, is a copper-containing enzyme found in most higher plants and animals, as well as many microbes that plays an essential role in synthesizing melanin. Previous kinetic studies in this laboratory have suggested that tyrosinase isolated from Russet potatoes has an unexpected temperature dependence, and retains high catalytic activity at elevated temperatures (up to 80 °C), which were confirmed in this study. At 25 °C, for example, tyrosinase has a $V_{\text{max}}$ value of 58 µM/min and a $K_M$ value of 4.6 µM. In contrast, at 80 °C, tyrosinase's $V_{\text{max}}$ and $K_M$ values are 55 µM/min and 2.9 µM, respectively. Further, labeling tyrosinase with the affinity label eosin-5-isothiocyanate, which covalently attaches to free lysine and arginine residues, effectively kills its activity: tyrosinase labeled with just 0.45 eosin-5-isothiocyanate molecules per enzyme reduces its $V_{\text{max}}$ from 58 µM/min to 0.33 µM/min at 25 °C, and from 55 µM/min to 1.5 µM/min at 80 °C. These data suggest that tyrosinase: (a) has a higher catalytic efficiency at 80 °C than it does at 25 °C, (b) binds substrate more tightly at higher temperatures than it does at lower temperatures, and (c) has at least one lysine or arginine that is vitally important in its catalytic mechanism.

36. AN OPEN INQUIRY LABORATORY FOR GENERAL CHEMISTRY STUDENTS: PURIFICATION OF RIVER WATER
Aaron J. Lacy and Joseph G. Nguyen
Mount Mercy University
Inquiry-based learning is a strategy that actively involves students in the exploration of the content, issues, and questions surrounding a concept. One of the difficulties in implementing inquiry-based experiments for various laboratory sessions involves the time it takes to plan and implement these types of experiments. However, inquiry-based laboratory experiments give the instructor an opportunity to help students learn the content and specific course concepts through exploration of a student-developed hypothesis. Ideally, students are then more reflective on their own learning, gain a deeper understanding of the concepts, and become better critical thinkers. An open inquiry laboratory experiment for general chemistry students involving the purification of water has been developed to help increase student awareness of global water issues. The presentation will discuss the results of student learning outcomes and student satisfaction surveys.
37. SYNTHESIS, CHARACTERIZATION AND APPLICATION OF PALLADIUM-NACNAC COMPLEXES
Nicole Morrow and Kristopher Keuseman
Mount Mercy University

The platinum-group metals (Pd, Pt, Rh, Ir, Ru and Os) and their compounds are important catalysts for a wide variety of chemical transformations. Coupling reactions and polymerization reactions catalyzed by these metals are of great importance for the synthesis of pharmaceuticals, advanced polymers, and agrochemicals. Our current research focuses on synthesis, characterization and application of palladium-NacNac complexes to catalysis of carbon-carbon bond forming reactions.

38. POPULATION GENETICS OF GRAY FOX (UROCYON CINEREOARGENTEUS) IN THE MIDWEST, USA
Jamison Ash, Thando May, and Dawn Reding
Luther College

The gray fox is a fur-bearing predator that ranges across much of North America and into central and northern South America. Based on body size and coat color variation, 16 subspecies have been described, 4 of which occur in the eastern USA. Gray fox populations may be declining across the Midwest, and the prairie gray fox subspecies (U. c. ocythus) has been petitioned for listing under the Endangered Species Act. It is unclear, however, whether the current subspecies delineations reflect the actual structure of gray fox populations. We are conducting a genetic study across the Midwest to identify if prairie gray fox are genetically unique relative to populations to the east, and to identify the geographic locations and underlying causes of the possible genetic boundaries. We are collecting tissue samples from harvested and road-killed animals for DNA analysis methods involving both maternally inherited mitochondrial DNA (mtDNA) and biparentally inherited nuclear DNA. Here, we present preliminary data from mtDNA sequences obtained from approximately 50 individuals collected from Wisconsin, Missouri, Kentucky, and North Carolina.

39. WINNERS AND LOSERS: PLANT SURVIVAL DURING PRAIRIE RECONSTRUCTION IN DROUGHT CONDITIONS
Brody Janssen, Stephanie Griffith, Jessica Riebkes, Derek Miner, Olivia Schouten, and Russ Benedict
Central College

Eastern Tallgrass Prairie used to cover much of central North America but now is one of the most critically endangered ecosystems on earth. Prairie restorations are occurring across the Midwest, but we know little about the details of replanting this complex ecosystem. This study is part of the Prairies For Agriculture Project (PFA), a long term research project that seeks to benefit humans and nature by incorporating diverse prairie plantings into the agricultural landscape. In the early stages of the PFA, drought conditions began, and they continue to the present day. This study quantified which species established well during drought conditions and which did not. By comparing our results to other research, we identified a set of species that usually are successful early in prairie restorations but did not establish well at our site. Some of these plants are important in the Tallgrass Prairie Ecosystem, such as Canada Wild Rye, Yellow Coneflower, and Rigid Goldenrod. Drought is one possible explanation for the relatively low success of these species at our site. Big Bluestem also did not start well in our plots, but that may be because this important plant takes several years to establish and is inconspicuous when it is young. Additionally, several plants in our plots established better than expected, possibly because they are tolerant of dry conditions and benefitted from the lack of competitors. This possibility needs further exploration.
40. IMPACT OF COMMON PLANTING TECHNIQUES ON PRAIRIE RECONSTRUCTION IN DROUGHT CONDITIONS

Derek Miner, Olivia Schouten, Jessica Riebkes, Stephanie Griffith, Brody Janssen, and Russ Benedict
Central College

Eastern Tallgrass Prairie used to cover much of central North America but now is one of the most critically endangered ecosystems on earth. Prairie restorations are occurring across the Midwest, but we know little about the details of replanting this complex ecosystem. This study is part of the Prairies For Agriculture Project (PFA), a long term research project that seeks to benefit humans and nature by incorporating diverse prairie plantings into the agricultural landscape. This study examined two aspects of planting prairies: the season of planting and the importance of mowing in the first year of growth. Plots were seeded either in spring or fall (with 16 or 64 species), and some were mowed during the first year of growth while others were un-mowed. To quantify establishment, we identified and counted plants in one square-meter frames during the first two years of growth. Drought conditions prevailed during this time, so our results reflect the impact of these conditions. Fall-planted plots were more successful than spring-planted plots for most species, including grasses. Mowing had weaker effects, but fall planted plots fared better if they were un-mowed, possibly as a result of the drought conditions. Our results generally contradict advice given in prairie restoration manuals. If our patterns persist during the next several years and we can further evaluate them, we likely will make new recommendations for prairie restoration, especially given that droughts and atypical weather patterns are expected to increase with the changing climate.

41. THE EFFECTS OF VERMICOMPOST ON TOMATO PLANT GROWTH AND THE HERBIVORE TOBACCO HORNWORM

Sarah Kielly, Mackenzie Moore, Nancy Seeberg, Kellie Solberg, and Jennifer Maxwell
Wartburg College

Agriculture is a major factor affecting land use and the environment throughout the world. To keep up with increasing demands for food, herbicides and pesticides are used increasingly. The detrimental effects of these practices are resulting in an interest and examination of the benefits of sustainable agriculture. A common form of sustainable agriculture is the use of compost, and in this experiment vermicompost was used, a method that utilizes the interaction between earthworms and microorganisms, resulting in nutrient-rich organic matter. This experiment consisted of using soil containing 30% vermicompost by volume and comparing this treatment to untreated soil in growing Wisconsin 55 heirloom tomato plants. Tobacco hornworms will later be introduced as an herbaceous pest to the tomato plant. The effects of vermicompost and the tobacco hornworm on tomato plant growth will be analyzed. Indirect effects of vermicompost on the tobacco hornworm will also be observed. The hypothesis is that vermicompost will have an effect on tomato plant growth and on the growth of the tobacco hornworm. It is predicted that vermicompost will increase tomato plant growth and will have a greater effect on decreasing the number and mass of tobacco hornworms on tomato plants. This experiment is in progress and will be completed in March 2014.

42. CONTINUED STUDIES OF HOME RANGE AND HABITAT USAGE OF HATCHLING AND JUVENILE ORNATE BOX TURTLES (TERRAPENE ORNATA) IN IOWA

Nikita K. Martinson1, Adam G. Coats2, Rachel H. Fendrich1, Kelsey King1, Sara Doerman3, Alex Karr2, C. Ochs, S. A. McCollum, and N. P. Bernstein2
Cornell College1, Mount Mercy University2, Iowa State University3

Minimum convex polygon home ranges of hatchling and juvenile ornate box turtles were measured during the summer of 2013 and compared with data from the previous two summers. Radios were placed on turtles as they emerged from the nest in the spring, were incidentally encountered, or captured at drift fences. The location of these turtles was recorded every other day until the turtle was killed, the signal was lost, or the turtle en-
tered winter dormancy. We also recorded habitat type and plant coverage above the turtle. Minimum convex polygon home ranges were calculated with ArcGIS and Geospatial Modeling Environment and compared with data from previous years. Hatchling home ranges were much smaller than that of juveniles. Hatchlings dispersed <100 m from the nest into tall vegetation and did not move much after that time. Juveniles had variable home ranges, some suggestive of the dumbbell home range that some adults demonstrate. Most of the time hatchlings and juveniles were under 90% cover or more, and both were most often found in prairie vegetation or shrubby vegetation around the edge of the prairie. Future studies will follow many of the same turtles in successive years to determine establishment of adult home ranges and also monitor growth rate.

43. DETERMINING THE TRENDS IN GENE FLOW BETWEEN TWO POPULATIONS OF SOUTHERN FLYING SQUIRRELS (GLAUCOMYS VOLANS) IN FRAGMENTED HABITATS OF EASTERN IOWA

Maria Mondragon, Stephany Miller, Rasika G. Muralige-Jayawickrama, and Gerald L. Zuercher
University of Dubuque

Southern flying squirrels (Glaucomys volans) is reported as distributed throughout Iowa only excluding the extreme northwest corner. However, Iowa considers G. volans to be a Species of Special Concern. Their abundance is officially rated as uncommon and their population trend is reported as unknown. This may stem from either the general lack of information on the species combined with the relatively few records for the state or it also may be predictive as flying squirrels are a forest-obligate species and Iowa has replaced most forests with agriculture. The forests that remain are highly fragmented. Flying squirrels have been studied at Mines of Spain Recreation Area, a state park, in eastern Iowa (Dubuque County) for several years. This project sought to determine whether other populations exist and, if so, whether gene flow exists among those populations. Flying squirrels were successfully captured from the Wapsi River Environmental Education Center (Scott County) thus establishing a second confirmed population in eastern Iowa. We tested the null hypothesis that no genetic differences occurred between the sampled populations. DNA was obtained from two sources, cheek epithelial cells and tail hair with follicles, from captured specimens. Extracted DNA was amplified with multiple primer sets targeted to microsatellite regions of the genomic DNA. Resultant PCR products were separated through gel electrophoresis to reveal DNA fragment sizes. Multiple alleles were detected for all primer sets tested so far. Preliminary results suggest that the two populations are diverging genetically. This implies that limited gene flow, if any, occurs and rejects the idea that flying squirrels in eastern Iowa may function as a metapopulation. We are currently testing four more primer sets to add to the existing assessment of genetic diversity and gene flow in two populations. We suggest further surveys for flying squirrels from forest fragments of varying distances in order to better assess the impact of landscape change on gene flow within flying squirrels.

44. UNDERSTANDING GRASSLAND INTERACTIONS USING BUTTERFLY RESPONSE TO VARIATIONS IN NECTAR PRODUCTION AND FLOWER DIVERSITY

Toni Proescholdt, John Delaney, and John Delaney
Iowa State University

Grasslands provide habitat for many animal species, and they also serve to improve soil and water quality. Given historic and ongoing losses of grasslands to row crop agriculture and development, it is essential to better understand the complex relationships between grassland animals and their environment in order to conserve and restore grassland habitat. This research focused on improving the understanding of the interactions between grassland butterflies and their environment. Topics explored include landscape history and management, nectar production, flower diversity, and butterfly abundance patterns and behavior. We analyzed butterfly activity in grassland plots as a function of floral resources (nectar volume and concentration). This research was conducted in three grassland types: (a) remnant prairies, (b) reconstructed prairies, and (c) moderately grazed cattle pastures. This work will provide an improved understanding of the interactions between butterflies and their resources and it will inform...
decision-makers interested in managing grasslands for pollinators.

45. EARTH, TREES, AND FIRE: ECOLOGICAL INTERACTIONS AT NIOMBRA VALLEY PRESERVE
Jordan Reinders, Kyle Cleveringa, Ben Schmidt, Emily Stricklin, Sarah Kaltenbach, Laurie Furlong, and Todd Tracy
Northwestern College

Fire plays a prominent role in shaping ecosystems. In 2012, a large wildfire burned much of the Nature Conservancy’s Niobrara Valley Preserve in north-central Nebraska. Areas burned include mixed grass prairie, ponderosa pine and oak woodlands, and stands of eastern redcedar, a fire-intolerant species that has become problematic in the Great Plains in the absence of fire. We collected soil samples in burned and nearby unburned areas of the preserve and analyzed samples for carbon and moisture content. We also used pitfall traps to survey ground-associated macroinvertebrates at each soil collection site. In this poster, we discuss our findings regarding interactions between fire history, soil characteristics, tree type (oak vs. cedar) and invertebrate diversity.

46. SEEDING RESTORATIONS: EVALUATING SEED VIABILITY TO IMPROVE RESTORATION OUTCOMES
Jessica Riebkes¹, Rebecca Barak², and Andrea Kramer²
Central College¹, Chicago Botanic Garden²

Tallgrass prairie restorations are occurring across the Great Plains in an effort to re-establish this once dominant landscape. Restored prairies often have fewer species than remnant prairies, so improving species establishment is essential to improving restoration outcomes. A fundamental part of establishing species is ensuring that the seed used is viable and matched to the conditions of the restoration site. Unfortunately, there is no universally accepted method to test seed viability prior to use in a restoration. To address this, we utilized three different viability testing methods (x-ray, tetrazolium, and germination) on four prairie forb species (Eryngium yuccifolium, Lespedeza capitata, Liatris aspera, Ratibida columnifera) to measure differences in viability calculations. Two accessions of each species were used, allowing us to compare seed collected in the same year from two different states. Additionally, we tested whether pretreatment could improve germination outcomes. Results showed that viability estimates did not significantly differ by testing method for 3 of our 4 study species, with the exception being E. yuccifolium (p < 0.0001). In this species, x-ray yielded significantly greater viability estimates than tetrazolium tests (p = 0.0123) or germination tests (p = 0.0000). Viability estimates differed significantly between accessions in three species (E. yuccifolium, L. capitata, L. aspera) (p < 0.0001). Pretreatment yielded significantly higher viability estimates in L. capitata (p < 0.0001) and in one accession of L. aspera (p = 0.0011) and E. yuccifolium (p = 0.0004) in the germination study. We suspect that E. yuccifolium may have yielded different results for each viability testing method because its pretreatment was not enough to break dormancy, among other factors. These results confirm that restoration practitioners should calculate seed requirements based on viability measures on a per species basis. For many species, the method used to calculate viability can be determined by available equipment and expertise, but for species with unknown dormancy requirements or those that may lose viability when stored, multiple methods may be needed.

47. THE EFFECTS OF MYCORRHIZAL FUNGI ON THE GROWTH AND SURVIVAL OF PRAIRIE SEEDLINGS DURING DROUGHT CONDITIONS
Olivia Schouten
Central College

Mycorrhizae are a mutualistic symbiosis formed between a species of fungi and a vascular plant and are widely used among prairie species. Mycorrhizae can increase the accumulation of biomass in the host plant, increase the drought tolerance of crop species, and possibly increase growth of plant seedlings. This project aimed to test how the presence of mycorrhizal fungi affects the survival and growth of prairie seedlings grown under drought conditions. Four species of native prairie plants (Andropogon gerardii, Sorghastrum nutans,
Artemisia ludoviciana, and Monarda fistulosa) were planted in sterilized and non-sterilized soil. Half of plants received drought watering, while the other half received non-drought watering. Plants were grown for 3.5 months and tested for germination, rate of growth, biomass produced, number of days of survival, and presence of mycorrhizal fungi. Preliminary results show there was no significant difference in germination of any species between mycorrhizal and non-mycorrhizal treatments. However, A. gerardii, A. ludoviciana, and M. fistulosa grown with mycorrhizae emerged from the soil significantly sooner than plants grown without mycorrhizae. Additional results to be discussed at a later time. As mycorrhizal fungi are present in lower numbers in disturbed sites, results from this project may have implications for the restoration of prairie ecosystems.

48. STATUS OF FRANKLIN'S GROUND SQUIRRELS (POLIOCITELLUS FRANKLINII) IN IOWA
James C. Stroh and Madison Knight
Morningside College

The purpose of this study was to attempt to locate active colonies of the Franklin's ground squirrel (Poliocitellus franklinii) within the state of Iowa. In February 2013 a survey was sent to 140 natural resource managers across the state of Iowa. Inquiries were sent via email to county, state, and federal professionals along with a picture of a Franklin's ground squirrel. Wildlife professionals from 44 counties responded to the survey. Individuals from eight counties confirmed sightings of Franklin's ground squirrels in the past 24 months. Furthermore, reports from Lee and Harrison Counties seem to indicate active populations of ground squirrels with several individuals reported. Results of this survey suggest that these organisms should at least be listed as a species of concern within the state of Iowa.

49. SPECIES DISTRIBUTION MODELING OF CLARKIA XANTIANA SPP. XANTIANA: REFINING CLIMATE PREDICTORS AND PREDICTING FUTURE DISTRIBUTIONS UNDER CLIMATE CHANGE
Jordan L. Young and Vincent M. Eckhart
Grinnell College

Understanding the controls of species’ geographic distributions is critical in basic ecology and in managing and conserving wild species. Species distribution modeling can help identify critical environmental variables that explain present distributions and may predict future ones. A key component of the modeling is to select biologically meaningful explanatory variables that apply to unoccupied regions and/or to the future. We created species distribution models (SDMs) of the California annual plant Clarkia xantiana spp. xantiana. A previous study found that simple climate variables such as seasonal means of precipitation and temperature help account for this species’ current distribution. The earlier study, however, was based on only four years’ weather data from automated stations. Moreover, the previous SDMs failed to account for likely effects of temperature and drought extremes and to project the distribution into future climates. Using four more years’ weather data and newly published climate projects for California in the 21st century, we were able to create more realistic SDMs that not only predict current distribution, but also predict the future distribution of suitable habitat in a warmer, drier landscape.

Ecology & Conservation Section Oral Presentations

50. COMPARING THE ABUNDANCE AND DIVERSITY OF SMALL MAMMALS BETWEEN REMNANT CORRIDORS AND NON-CORRIDOR AREAS
Amy N. Holley, Jennifer L. Stoffel, and Jennifer D. White
Upper Iowa University

Biological corridors are linear paths that connect two areas with similar vegetation types and are bordered by contrasting areas. The majority of the research conducted on biological corridors focuses on those used by large mammals. However, small
mammals are essential in the ecosystem because they consume a large variety of insects, disperse plant seeds, aerate the soil by burrowing, and serve as a source of prey for several species. The goal of this study was to gather data on the presence and diversity of small mammal species within corridors in comparison to non-corridor areas. For this study, two corridor and two non-corridor areas were identified within Fayette County, Iowa. On September 10, 2013, six 3x3.5x9" collapsible Sherman Live Traps were placed 20 meters apart in a single linear trap line within each of the two corridor and two non-corridor areas. Traps were set three days a week and were monitored twice a day. Captured mammals were weighed, the tail lengths were measured, and the animals were marked before being released. There were a total of 44 different individuals captured and marked. In all a total of 59 animals were captured which included six species and 15 recaptures. Community similarity was 0.33 and the average for the Simpson's diversity index was 0.56 for corridor sites and 0.25 for non-corridor sites. Relative abundance was highest for the white-footed mouse in corridor and non-corridor areas. The non-corridor sites had higher species richness than the corridor sites. In the non-corridor sites, several individuals showed signs of breeding as opposed to none in the corridor areas. Results indicated the non-corridor sites were being used as home range while corridors were used for movement.

51. POSSIBLE DISAPPEARANCE OF RED-BACKED VOLES (MYODES GAPPERI) IN WINNEBAGO COUNTY: IS CLIMATE CHANGE A CONTRIBUTING FACTOR?

Andrew Hudson and Paul Bartelt
Waldorf College

Red-backed voles (Myodes gapperi; RBV) have not been found in Iowa since 1982. Winnebago County in extreme north-central Iowa sits in what is (or recently was) the southern-most limit of RBV's range in the Upper Midwest. This study investigates whether climate or habitat change might play a role in the possible extinction of RBVs from Winnebago County. Since 1982, unsuccessful attempts to trap RBVs in Pilot Knob State Park (PKSP) occurred in 2000 and most recently in 2012 and 2013; trapping in 2012 on private land 4 km north of PKSP (where RBVs once occurred) also was unsuccessful. We successfully caught a RBV on private land near Cannon Falls, MN (~144 km north of PKSP) after seven days of prebaiting and eight days of trapping with a 9x7 grid of Sherman box traps. In October 2013, in PKSP, we used two rectangular grids (4x22 and 9x9) of traps, three weeks of prebaiting and three weeks of trapping. We compared habitat and climate conditions of the Cannon Falls and PKSP sites. We collected historical weather data over the last three decades from Cannon Falls, PKSP, and three intermediate sites with possible suitable habitat for RBVs. These data show trends of increasing yearly average maximum and minimum temperatures, and in the number of frost free days. We estimated understory coverage to be 15% at PKSP sites and 21% at the Cannon Falls site. Analysis of historical aerial photographs of PKSP and recent aerial photographs of Cannon Falls, MN, are currently underway.

52. NATURAL RESOURCE INVENTORY OF URBAN HABITATS IN DES MOINES PARKS AND OPEN SPACE

Thomas Rosburg
Drake University

A natural resource inventory was conducted during 2011 to provide ecological information on the current state of conservation lands in the Des Moines parks system. The project's overall goals were focused on the delineation and identification of existing plant communities, a description of the current ecological status of ecosystems and vegetation, an evaluation of the historic vegetation, and an assessment of management and restoration options. The conservation value and importance of the park system is demonstrated by the presence of an impressive number of vascular plant species; the 651 species observed includes 459 that are native to central Iowa, which represents 30% of the native flora of Iowa. There were 8 plant species observed that are endangered, threatened, or special concern species in Iowa. The 459 native species observed include 78 (17.0%) that have an Iowa Coefficient of Conserv-
atism of 7, 8, 9, or 10. One species, spreading sand mat (*Euphorbia humistrata*) is a new record for Iowa. Three species are new records for Polk County. There are 80 natural or semi-natural plant associations supported by park system and they account for about 53.6% of the total area. Among the natural/semi-natural associations, forest associations account for the greatest area (64.6%), followed by herbaceous associations (22.8%), woodlands (6.0%) and wetlands (5.8%). The most critical management task needed in the park system is invasive species control. Among the 180 non-native species encountered in the park system, 45 could be labeled invasive (approximately 25%). Nearly 3,000 acres of native vegetation was mapped using soil data, which indicated the park lands were historically dominated by savanna (51%) and prairie (35.3%).

53. CONSERVATION ASSESSMENTS OF 6 IOWA STATE PRESERVES

Wayne Schennum and John Pearson
Illinois State Academy of Science, Iowa Department of Natural Resources

The Iowa State Preserves System was founded in 1965 to protect remnants of the state’s natural and cultural heritage. To enable the current preserves to sustain their value, the Iowa State Preserves Board and Iowa DNR recognized that periodic reevaluations were necessary. Six preserves were chosen for ecological analyses in 2013: Williams Prairie (30 a), Marietta Sand Prairie (17 a), Nestor Stiles Prairie (10 a), Cayler Prairie (160 a), Stinson Prairie (3 a), and Hayden Prairie (240 a). Data was collected on each site’s flora and natural communities, including: community mapping using GPS and aerial photos; listing all vascular plants and their relative abundances; evaluating community quality, quantitatively and qualitatively; describing disturbances; describing EN, TH, and SC plants; noting habitat features for rare animals and animal assemblages; describing management procedures needed to maintain a preserve’s quality. A significant portion of 5 sites had very high and/or high quality prairie and/or sedge meadow, characterized by high species richness and diversity and an open structure with an integrated mix of grasses and forbs. Hayden, Stinson, and Cayler Prairies were exceptional. All three had substantial areas of grade A and/or B black soil prairie and high complements of conservative species. Hayden Prairie had 3 communities with species counts between 75 and 100, with conservatives as high as 60 per cent. Five preserves were free of invasive woody species due to excellent controlled burning and brush cutting programs. Smooth brome and agricultural runoff were more frequent problems. The Iowa State Preserves Board, County Conservation Boards, and Iowa DNR can be confident that all 6 preserves remain excellent examples of Iowa’s Natural Heritage.

54. DISCRETE-EVENT SIMULATION APPLIED TO THE DESIGN AND OPTIMIZATION OF BIOMASS-TO-BIOREFINERY SUPPLY CHAINS

Gabriel Bravo-Palacios, Mark Mba Wright, and Robert C. Brown
Iowa State University

Government-mandated targets of fuel production in the United States point to increasing the contribution of biofuels in the nation’s fuel supply to 36 billion gallons by 2022. From the required production of biofuel, at least 16 billion gallons should proceed from lignocellulosic biomass sources. However, lignocellulosic biomass supply logistics remain uncertain due to a lack of industrial data. Therefore, emerging strategies to boost the advanced biofuel industry need to incorporate the design of biomass-to-biorefinery supply chains. An element of this design is discrete-event simulation (DES), which is a novel approach to the design of biomass-to-biorefinery supply chains. The main purpose of this study is to analyze the performance and logistics of biomass supply to distributed and/or centralized processing plants for the production of biofuels under uncertainty. DES models describe state changes at discrete times to
demonstrate the relationship between the collection, storage, transportation, and pretreatment operations for supplying biomass to biorefineries. The model objects include farms, storage sites, pretreatment and processing plants that are connected by queues delineating transportation routes and distances. These objects have dynamic properties that are subject to uncertainty, such as storage load, processing time, vehicle speed, and processing cost. Preliminary results for a centralized scenario indicate that corn stover overall supply cost is $117.24 ± 0.12/Mg. The majority of this cost is due to nutrient replenishment costs and transport costs, which respectively contribute 22% and 25% to the total cost. These costs were later compared to a distributed processing scenario as a potential strategy towards a more robust biomass supply chain.

55. THE IMPACT OF LEARNING RATES ON THE PRODUCTION COSTS AND OPTIMAL SIZE OF BIOREFINERIES

Tannon Daugaard, Lucas A. Mutti, Mark M. Wright, Robert C. Brown, and Paul Componation
Iowa State University

The purpose of this study is to estimate the potential impact of learning rates on the emerging advanced biofuel industry in the United States. Industry statistics indicate that technology-learning rates can dramatically reduce both feedstock and biofuel production costs. The Brazilian sugarcane ethanol and the United States corn ethanol industries exhibit drastic historical cost reductions that can be attributed to learning factors. This study compares predictions of three different types of models: learning-based economies of scale, S-Curve and Stanford-B models. Results suggest that increasing capital and feedstock learning rates could significantly reduce the production costs and optimal size of biorefineries. The Stanford-B model predicts cost reductions of 55 to 73% for biofuels compared to base case estimates. One example shows that optimal costs for Fischer-Tropsch diesel decrease from $4.42/gallon to $2.00/gallon. The optimal capacities range from small-scale (grain ethanol and fast pyrolysis) producing 16 million gallons per year to large-scale gasification facilities with 210 million gallons per year capacity. Sensitivity analysis shows that improving capital and feedstock delivery learning rates has a stronger impact on reducing costs than increasing industry experience. This suggests that there is an economic incentive to invest in strategies that increase the learning rate for advanced biofuel production.

56. ENERGY EFFICIENT DEHUMIDIFICATION BY SOLAR DRIVEN DESICCANT SYSTEMS

Ryan Everly
Iowa State University

In regions with high humidity levels, desiccant systems are extremely effective as renewable dehumidifiers in buildings. They are also environmentally friendly, with water as their only direct emission. The resulting dehumidification of the desiccant system engenders a more comfortable human climate; it reduces the need for air cooling and therefore lowers the energy load on a building. However, the renewability of the desiccant solution is dependent on a hot water tank which is currently powered by external energy. This study will use a thermal solar tank instead of a standard domestic hot water tank to provide the heat needed to recharge the desiccant solution, eliminating reliance on outside energy. The study will observe and compare the energy load needed for air cooling before and after the introduction of a solar driven liquid desiccant system. The Interlock house, a net zero energy building equipped with a solar powered thermal solar tank, will be used as a test subject. This research will provide valuable data pertaining to the effectiveness and efficiency of solar driven desiccant systems, leading to their introduction into the common household.

57. A TECHNO-ECONOMIC ANALYSIS OF BIO-OIL STABILIZATION FOR INSERTION INTO PETROLEUM REFINERIES AND UPGRADING TO TRANSPORTATION FUELS

Wenqin Li, Mark Mba Wright, and Robert Brown
Iowa State University

This project is part of a collaborative effort between Iowa State University, Pacific Northwest National Laboratory and University of Oklahoma.
tasked with the objective to stabilize bio-oil fractions for insertion into petroleum refineries. Bio-oil from fast pyrolysis of biomass is a complex mixture of unstable organic compounds. These organic compounds react under standard room conditions resulting in increases in bio-oil viscosity and water content, both detrimental for bio-oil use in fuel applications. In this study, we evaluate the stabilization of bio-oil recovered from the fast pyrolysis of red oak and corn stover in a fluidized bed pyrolyzer and a fractionation recovery system. The fractionation system consists of a series of condensers, and electrostatic precipitators designed to separate bio-oil into four fractions: light oxygenates, soluble carbohydrates, middle fraction, and clean phenolic oligomers. Preliminary results indicate that bio-oil can be fractionated into 26% oxygenates, 20% carbohydrates, 8.5% middle fraction, and 46% oligomers. Each of these fractions requires appropriate stabilization methods and upgrading strategies that will increase production costs. Therefore, the outcome of this analysis is an understanding of the cost-benefit tradeoff of bio-oil stabilization for the production of renewable transportation fuels.

58. REACTION KINETIC DEVELOPMENT FOR BIOMASS THERMALLY DECOMPOSING PROCESSES
Fenglei Qi, and Mark Mba Wright
Iowa State University

Biomass thermochemical conversion is an approach of wide interest to produce renewable biofuels. Limited knowledge of reaction kinetics of the biomass conversion process poses difficulties on the design of conversion reactors and control of the product quality. In this research, a systematic method integrating parameter estimation, statistical analysis and design of experiment (DOE) is developed to derive empirical kinetic models. For parameter estimation, multi-objective optimization methods based on the non-dominated sorting generic algorithm (NSGA-II) and multi-objective particle swarm optimization (MOPSO) frameworks are employed to search for globally optimal solutions. The uniqueness of parameter estimate is assessed by involving Fisher information matrix (FIM) and correlation matrix, and the confidence intervals of estimates are determined by Student’s t-test with linear approximation of covariance matrix. Two case studies, biomass torrefaction and cellulose fast pyrolysis, are demonstrated for assessing the effectiveness of the method. Results show that MOPSO and NSGA-II algorithms both have the ability to search for globally optimal solutions and their results are found to be statistically identical (95% confidence interval). Besides, the estimability of the models under specific DOE was investigated and this analysis validates the necessity of assessing the uniqueness of parameter estimates, and the information obtained from FIM was shown to be helpful for further DOE.

59. A DISTRIBUTED CONSENSUS BASED TECHNIQUE FOR OPTIMAL ECONOMIC DISPATCH IN SMART GRIDS
Raghuraman Mudumbai, Soura Dasgupta, and Muhammad Mahboob-Ur Rahman
University of Iowa

Economic dispatch of electrical power generators is the problem of how to determine which generators should be producing electrical power, and at which times they should do so, in order to most efficiently meet the demand for electricity. The problem of economic dispatch is becoming even more complex with the increasing entry of alternative energy sources into the grid. Because these alternative energy sources are intermittent in time and dispersed in geography, they require the ability of the electric power grid to dynamically adjust generation and consumption in order to use the energy efficiently. Additionally, techniques to defer energy consumption such as energy storage and demand-response units offer not only the potential benefits of increasing grid efficiency, but they also present additional complexities in the problem of how to efficiently and dynamically balance genera-
tion and demand in electrical power grids. We present a new decentralized approach, based on distributed consensus theory, for optimal economic dispatch in smart grids. In this approach, generators independently make adjustments to their power output based on three pieces of information: (a) their own marginal cost of generation, (b) the frequency deviation measured from the power line, and (c) the marginal generation costs of a subset of other participating generators. Using these three pieces of information, generators dynamically adjust their power outputs in order to minimize the overall cost of meeting demand. Further, they do so without the need for a centralized controller and without the need for communicating with all the generators on the grid.

60. EXPERIMENTAL STUDY OF GLOBAL AND LOCAL FLAME RESPONSE TO ACOUSTIC PERTURBATION AMPLITUDES
Jianan Zhang, K. Kaufman, and A. Ratner
University of Iowa

A low swirl burner is used to study thermoacoustic instability under different acoustic perturbation levels. For a constant driving frequency of 125 Hz, current research examined the effects of velocity and driving pressure amplitude (0.04-1.12% of atmospheric pressure) on the global and local flame response. The Rayleigh Index (RI) is used as an indicator of inhibiting (RI with negative value) or exciting (RI with positive value) of thermoacoustic instability. Furthermore, the root mean square of the Rayleigh index (RIRMS) was analyzed as the global response of the flame. Weighted RIRMS results show that a linear and a nonlinear changing trend in the global response. For the high velocity cases, when the amplitude of the acoustic forcing is increased, the local coupling structures are found to move along the edge of the flame toward the flame base. Using a locally-weighted RIRMS, the contribution of the positive and negative valued toroidal structures on the global RIRMS was examined. Under the low velocity condition, the positive and negative value regions play similar roles in their contribution to the global flame response. However, as the velocity is increased, the positive value regions (with emphasis on the second positive region) become more dominant than the negative value regions in global flame response contribution.

61. PARAMETRIC STUDY OF BIOMASS GASIFICATION IN A PILOT-SCALE GASIFIER
Yunye Shi, Tejasvi Sharma, Guiyan Zhang, and Albert Ratner
University of Iowa

A parametric study of the gasification of corn kernels has been performed on an experimental, pilot-scale (250 lbs/hour) gasification unit. A comparison was made of the performance of the gasifier as a function of operational parameter, in terms of producer gas production and composition. In these experiments, corn kernels was used, so that the shapes and sized of the materials did not influence the results. Experiments were conducted with varying temperature of fuel bed, fuel-to-air ratio, and fuel bed level. For each experimental condition, the permanent gas composition was measured continuously by gas chromatography (GC). Tars were collected according to CEN Standard. Biochar were weighed for mass balance. The results from the study indicate that there were significant differences between various operational parameter in terms of producer gas concentration, tar production and char percentage.

62. STOKER BOILER CFD MODELING IMPROVEMENTS THROUGH ALTERNATIVE HEAT EXCHANGER MODELING
A.J. Depman, M. Ghamari, A. Ratner
University of Iowa

A significant consideration when using a coal- or biomass fired boiler to generate power is the amount of atmosphere-damaging emissions released during combustion. Accurate models and realistic simulations are essential in developing cleaner and more efficient coal- and biomass-fired boilers. Using the CFD simulation software Fluent, The University of Iowa previously created a model of an industrial boiler that adequately compares the practice of co-firing biomass and coal against firing only coal. The simulations used in this comparison, however, show significant circulation zones and an unrealistic temperature profile inside the boiler furnace. While this model is effective for
comparing the relative decrease in emissions when co-firing with biomass versus exclusively coal combustion, it does not present a realistic simulation of biomass or coal combustion. The purpose of the current work is to develop a more realistic model for use in the simulation of coal combustion. This model will eventually be applied to simulations showing the effectiveness of adding renewable fuels to the coal to reduce emissions and increase the boiler efficiency. Calculations for the proximate and ultimate analysis of coal, as well as properties necessary for energy and mass flux computations, have been updated in the current model. The previous boiler geometry was split into more sections in order to be able to modify the mesh grid in specific regions, and different grid sizes were implemented. The coal bed model—a simple two-dimensional distribution of energy and mass fluxes from the grate—was kept the same as in the previous model due to the complexities involved in calculating coal devolutilization and solid coal combustion simultaneously. Several approaches have been attempted to reduce the circulation zones and generate a realistic temperature profile. The energy sink term in the boiler, representing the energy removed by the water pipes in the heat exchanger, was spread out over a larger volume in order to decrease the magnitude of the temperature gradients present in that region. The negative source term was also split between the heat exchanger volume and the stack volume in an attempt to lower the maximum temperature and reduce the circulation in those zones. The geometry was simplified to the most basic form of the boiler in an attempt to generate a more realistic flow path and reduce circulation. Alternatively, instead of using a negative energy source term, the built-in heat exchanger model in Fluent was implemented to try to reduce the circulation in the heat exchanger region. This method proved to be the most effective in reducing recirculation zones and decreasing high temperature gradients. The maximum temperature in the boiler was still found to be higher than in the real system, mostly due to unresolved regions of high temperature. Velocities for the secondary air inlets above the grate combustion zone were modified in an attempt to eliminate high temperature regions and alter the flow path to a more realistic one.

While the current model of the coal-fired boiler has a higher overall temperature than the previous one, circulation zones are almost completely eliminated, the flow path has been improved, and the temperature profile in the boiler is more realistic.

63. NEW SCHOOL: BUILDING AND ARCHITECTURE FOR SUSTAINABLE LIVING

Andrea Wheeler, Naghmeh Pak, and Megan Fowler
Iowa State University

From the perspective of Europe, the US has been criticized as slow to address its carbon emissions. On June 25, 2013, however, President Obama announced a plan to reduce carbon emissions, increase the use of clean energy sources, and mitigate the effects of climate change. At Georgetown University, he declared "—the world still looks to America to lead.... I am convinced this is the fight America can, and will, lead in the 21st century.... We'll need scientists to design new fuels, and we'll need farmers to grow new fuels. We'll need engineers to devise new technologies, and we'll need businesses to make and sell those technologies. We'll need workers to operate assembly lines that hum with high-tech, zero-carbon components, but we'll also need builders to hammer into place the foundations for a new clean energy era (The White House, Office of the Press Secretary, 2013). The focus on energy and energy innovation is evident, but so too is the multidisciplinary nature of the problem. The President's Climate Action Plan, launched on the same day, describes the expansion of the President’s Better Buildings Challenge, from commercial and industrial buildings, to multifamily housing and to synchronized building codes improving the efficiency of federally owned and supported building stock. The aim is to support local efforts to build communities less dependent on limited energy resources and more able to adapt to the effects of climate impacts (US Department of Energy, 2013). Nevertheless, without building user communities educated about sustainability, buildings risk being poorly utilized and innovative energy technologies misunderstood. As Lucas argues: “environmental behaviors will require complex and innovative policies and practical interventions across a wide range of different sec-
tors and at every level of society (i.e. individual, household, community, organizational, institutional and across whole systems) (Lucas et al, 2008, 456). The ability of governments to lead this change through policy alone is problematic (Demos/ Green Alliance, 2003). The move towards a more sustainable community depends as much on the cooperation of the people who occupy those environments as the built environments that can be created (Shove, 2005, 2010). Using the example of the architecture of new schools built in Iowa, US, the paper compares UK, European contexts, examining the growth of research into the relationship of community engagement, energy performance and functionality - including comfort - in the move towards more school sustainable communities. This paper addresses the multidisciplinary problem: how to design to encourage and maintain, building user commitment to sustainable lifestyles and the research questions the relationship between policy, community education and sustainable architecture. The paper consists of two parts: a desk-based discussion of sustainable building initiatives illustrated by case studies of new Iowan schools, and a study of contemporary and international theory in sustainable school design. The research is supported by a seed grant from an Iowa NSF/ESP CoR initiative.

64. TESTING FOR PRESENCE OF TICK-BORNE DISEASE AND COINFECTION
Ellen Behrens
Luther College

The purpose of this study was to develop PCR assays to detect a number of tick-borne pathogens, and to ultimately estimate prevalence of these tick-borne diseases in the deer ticks inhabiting the area surrounding Luther College. Deer ticks from natural lands around Luther College campus and Decorah, Iowa were collected using a tick drag. Samples of three tick-borne pathogens (Borrelia burgdorferi, Anaplasma phagocytophilum, and Babesia microti) were obtained and used for the development of PCR assays. PCR assays for Anaplasma and Lyme disease was successfully implemented.

65. HIGH VELOCITY HAND DRYERS AND MICROBES, WHAT'S THE RUB?
Carly J. Gilliland, Brian T. Bristow
Lakes Community College

Electric hand dryers are common in public restrooms and are steadily replacing paper towels as businesses and institutions attempt to reduce costs and become green. Previous research at Iowa Lakes Community College has demonstrated the possibility that hand dryers could transfer microbes from person to person. This year we have attempted to quantify the degree to which high velocity hand dryers pose a potential risk to users. For the past four years, students at Iowa Lakes have made before and after comparisons of bacterial load on the fingertips dependent upon hand drying technique. After completing over 300 trials, the evidence is clear that using our hand dryers increases the number of bacteria on the fingers while using paper towels or simply wiping the hands on the subjects pants reduces the average load by about 50%. Additionally, we cultured swab samples of multiple surfaces on campus and have found that, by far, the largest number of bacteria on any surface tested came from the wall directly below the hand dryer. The wall directly below the hand dryer harbored 7 times as many bacteria as any other surface tested and nearly 700 times as many bacteria as the wall one meter to the side of the hand dryer. Coincidentally, air intake for the hand dryer is directly adjacent to the highest load of bacteria. While we are continually being exposed to microbes, this unnecessary exposure to such a high number of microbes from unknown sources should draw some concern.
66. TRICLOSAN EFFECTS ON ALGAE IN STORM LAKE, IOWA, WWTP RECEIVING STREAM
Ashley Rogers, Chelsey Snyder, and Melinda Coogan
Buena Vista University

Triclosan (5-chloro-2-[2,4-dichloro-phenoxy]-phenol), TCS, is a chlorinated aromatic compound that is used as a synthetic broad-spectrum antimicrobial agent. Triclosan is found in many household and personal care products, such as hand soap, toothpaste, deodorant soaps, hand lotions, and mouthwashes. Triclosan persists through multiple steps in Wastewater Treatment Plant (WWTP) processing and is ultimately released as part of effluent waters into natural aquatic systems or receiving streams. Because TCS can inhibit the FabI lipid synthesis pathway, which is crucial to membrane development, algae are being sacrificed when exposed to environmentally-relevant concentrations of TCS in receiving streams. Algae produce approximately half the total primary production at the base of the food chain, so loss of algae may affect stream energetics. During this experiment, we collected samples from Outlet Creek, which is the receiving stream for the Storm Lake, Iowa WWTP. Our hypothesis stated that the receiving stream sites in closer proximity to the WWTP outfall would have lower chlorophyll a levels due to higher TCS concentrations. To test this hypothesis, we first took samples of water and algae from specified sites along Outlet Creek. Using GC/MS and spectrophotometric methods, we assessed the TCS and algal levels at each site. We found an inverse relationship between TCS levels and chlorophyll a levels. As TCS levels increased, chlorophyll a levels decreased, however a significant difference was not found between the data sets (p = 0.20; α = 0.05; n = 3). Although our hypothesis was not supported statistically, there does appear to be an effect of TCS levels on algal composition in Outlet Creek. Future experimentation should involve greater numbers of sites and samples collected over longer time periods.

67. DETERMINATION OF LC50 AND THE EFFECT OF TRICLOSAN EXPOSURE ON ZEBRAFISH HATCHLING MORPHOLOGY
Mycaela Crouse, Amanda Kahl, Shannon Snyder, Rachel Spooner, Ellie Du Pre, and Nicole Palenske
Central College

Triclosan (TCS), a common synthetic biocide, is now one of the top chemicals found in surface waters due to excessive use and has recently been discovered in the urine of young girls and in breast milk. Recent research has implicated Triclosan as a thyroid hormone disruptor. The goal of this experiment was to determine the LC50 value of TCS for newly hatched zebrafish. After hatching, the zebrafish (ZIRC grant #RR12546) were transferred to a control solution (E2 solution) for 72 hours and were then placed in a feeding dish containing paramecium for 2-3 hours. Zebrafish were then exposed to TCS concentrations ranging from 170-250 mg/L TCS for 96 hours. Survivability was determined by the presence of a heartbeat as viewed through a microscope. The LC50 for the newly hatched zebrafish in this study was significantly lower than the LC50 for embryos and adult zebrafish reported in other studies. A general trend of increasing morphological defects was observed in proportion to the concentration of TCS exposure. These data indicate that newly hatched zebrafish are more susceptible to TCS exposure and that further research into the effects of TCS on developmental stages of life should be explored.

68. PREVALENCE OF MULTI-DRUG RESISTANT BACTERIA IN NORTHEAST IOWA STREAMS
Anna Gudjonsdottir, Matthew Rosene, Rebekah Schulz, and Eric Baack, Luther College
Over 70% of antibiotics purchased in the United States are used for healthy livestock, and as a result, concentrated animal feeding operations (CAFOs) are being investigated as potential breeding sites for antibiotic-resistance in bacteria. To further investigate this, water samples collected from both streams near CAFOs and streams that didn’t have CAFO land upstream were filtered through a membrane which was then placed on media containing tetracycline. Bacteria that grew was then cultured on media containing either ampicillin, bacitracin, methicillin, or streptomycin in order to test for multi-drug resistance, characterized by resistance to four or more antibiotics. The majority of colonies that were tetracycline-resistant showed resistance to at least four other antibiotics with an average fraction of 0.306 multi-drug resistant to tetracycline at non-CAFO sites and 0.334 at CAFO sites. With the Upper Iowa River being such a popular destination for recreational activities, many individuals are likely being regularly exposed to multi-drug resistant bacteria.

**69. STUDY OF THE EFFECT OF URBAN LIFE IN THE WATER QUALITY OF THE RACOON AND DES MOINES RIVER WATERSHED**

Annie E. Stark, Alex Welsch, and Corbin J. Zea
Grand View University

The topic of water quality is a hot button issue that strikes very close to home in Iowa. Many people are quick to blame the farmer for the amount of fertilizer runoff that is found creeping into Iowa’s waterways. In this study, we look at the effect that the urban area of Des Moines has on the Des Moines River watershed over the course of the Spring 2014. We will monitor various water quality factors such as dissolved oxygen, pH, presence of heavy metal ions, nitrate, and phosphate concentrations. We hope that this information will give us a clearer picture about the impact that urban areas have on water quality.

**70. SPHINGOMONAS BREAKDOWN OF 17β-ESTRADIOL IN WASTEWATER TREATMENT**

Kayla Hartmann, Thom Bonagura, and Melinda Coogan
Buena Vista University

*Sphingomonas* KC8, a type of bacteria identified in a wastewater treatment plant in Tennessee, has been shown to have the ability to breakdown estrogenic compounds, including estrogenic-Endocrine Disrupting Compounds (e-EDC’s) such as 17β-estradiol in wastewater. Estrogenic-Endocrine Disrupting Compounds mimic estrogen in an organism and interfere with the endocrine system’s functions, which has variable effects on the organisms that metabolize them. Preliminary breakdown assessments with KC8 conducted by researchers at Texas A&M University, and replicated on a small scale in our lab, show that KC8 does have the ability to completely breakdown 17β-estradiol in the span of a few days. In this research, we initially determined levels of 17β-estradiol going into and coming out of the Storm Lake, Iowa, Wastewater Treatment Plant by using ELISA assessments using influent and effluent water samples from the plant. We then investigated the potential presence of *Sphingomonas* KC8 in the treatment plant by using genetic analyses with PCR and KC8 primers. While it was found that an unidentified process in the treatment plant did reduce the 17β-estradiol concentrations from more than 25 ppt to 5-6 ppt, the presence of *Sphingomonas* KC8 could not be identified, leading to the conclusion that a different process is potentially reducing 17β-estradiol concentrations.

**71. CAN LUNG FUNCTION BE ALTERED BY METOLACHLOR EXPOSURE? STUDY OF INFLAMMATORY CYTOKINE PRODUCTION IN HUMAN ALVEOLAR CELLS**

Hannah E. Wilson and Kavita R. Dhanwada
University of Northern Iowa

Metolachlor, a chloroacetanilide herbicide, controls pre- and post-emergent weeds and is routinely used in the Midwestern US. It has been increasingly detected in surface and ground water, and can also contaminate the atmosphere via drift during application and can be inhaled by humans. This pesticide has been demonstrated as having an inhibitory effect on cell growth in several cell types: Our laboratory had previously found that...
the growth of human alveolar monocytes and macrophages (THP-1) is inhibited after pesticide exposure. While exposure to metolachlor by inhalation and its inhibitory growth effects on lung immune cells have been shown, little is known about its effects on the inflammatory processes in the human lung. The objective of the current research is to determine the effects of metolachlor exposure on inflammatory cytokine production, specifically the production of human interleukins IL-1β and IL-10. Given that both of these cytokines are mediators of inflammatory response and are involved in multiple other cellular processes, including differentiation, proliferation, and apoptosis, over- or under-production of these important cytokines could adversely affect lung immune function. ELISA assays will be used to quantify IL-1β and IL-10 production at varying concentrations and time points of metolachlor exposure. Results will be demonstrated in undifferentiated monocytes and the functional (differentiated) macrophages will be discussed.

Geology Section
Poster Presentations

72. ELECTRICAL RESISTIVITY TOMOGRAPHY AS A HYDROGEO PHYSICAL TOOL FOR CHARACTERIZING SURFACE WATER-GROUNDWATER INTERACTIONS

Samuel J. Smidt, and Adam S. Ward
University of Iowa

Electrical resistivity (ER) tomography has emerged as a popular choice for characterizing surface water-groundwater interactions in a stream setting due to its ability to collect high-resolution, in-situ data. As electrical pulses are sent through an electrode transect, a 2-D voltage potential field is created perpendicular to a streambed and variances in subsurface fluid conductivity can be detected in a spatially and temporally inclusive framework. When coupled with a solute stream tracer, ER tomography can detect saline surface water interacting with groundwater flowpaths due to the increased conductivity of saline water. As saline flowpaths cross the electrical plane, solute time-series captured at individual pixels throughout the plane can be used to quantify spatial extent and transport metrics (e.g., transit times, temporal skewness) of surface water-groundwater exchange. The results of this approach are geophysical datasets fully capable of conceptualizing surface water-groundwater interactions in a stream setting at temporal and spatial resolutions unattainable using other methods.

Geology Section
Oral Presentations

73. RECENT INSIGHTS INTO THE EVOLUTION OF THE MANSON IMPACT STRUCTURE, IOWA

Raymond R. Anderson
The University of Iowa

Recent problems with one of their 2 town wells has prompted the City of Manson to seek an additional supply of water. Located near the center of the Manson Impact Structure, a buried 74 million year old meteorite impact crater in north-central Iowa, the town has been utilizing the only naturally soft groundwater in Iowa since the its first municipal well tapped the structure's Central Peak Aquifer in 1905. Since 2010 the search for another source of water has included the drilling of three new wells within the town limits. While none of these wells produced required quantities of water, the study of samples collected during drilling and several down-hole videos have provided a wealth of new information on the nature of the Central Peak Aquifer. A parallel investigation of the quality of water from the Manson wells and from private wells that penetrate each of the three aquifers in area of the Manson Central Peak has led to a much better understanding of the hydrogeology of the Central Peak Aquifer. Combining the infor-
74. ENGAGING UNDERGRADUATE STUDENTS IN GEOARCHAEOLOGY - EXPLORING SICILY AND IOWA

Chad Heinzel, Victoria Arreola, John Chesley, and Erin Boyd
University of Northern Iowa

University of Northern Iowa Earth Scientists embarked on geoarchaeological adventures this past summer near Partanna, Sicily. Our objectives were to begin developing two data sets: (1) characterization of natural resources (clay and stone); and (2) confirm the presence of a geoarchaeological record capable of addressing questions surrounding the Neolithic Revolution (6000 BC). We collected over one-hundred geologic (clay, stone, and ceramic) samples. Analyses (chemical and physical) of these samples are facilitating interpretations that directly tie western Sicily's prehistoric communities with their geologic environment, providing a window into their lives. Our efforts have identified an abundance of natural resources as well as a robust archaeological record dating back to the Mesolithic (10,000 BC). One of the most promising finds was a paleosol (buried soil) with significant cultural materials. These artefacts (lithic and ceramic) date from the Late Mesolithic to Early Neolithic. This paleosol may represent a soil, natural time-capsule, of the Neolithic Revolution or time when humanity was evolving from hunting/gathering to agrarian lifestyles. In addition, to identifying and characterizing the natural resources and artifacts we constructed a series of Geographic Information Systems (GIS) maps that will serve as the basis for future work investigating western Sicily's prehistoric landscape/climate changes, settlement/labor patterns and archaeological site prospecting. By characterizing the interrelationships between humanity, natural resources, and climate variability our research aims to accurately portray and learn from the geoarchaeological record. We aim to learn from the past, engage the present, and build a promising future.

Iowa Science Teaching Section
Poster Presentations

75. READY FOR THE NEXT GENERATION SCIENCE STANDARDS?

Ken L. Turner, Jr.¹ and Amy Van Deuren²
University of Dubuque¹, National Louis University²

The Next Generation Science Standards, NGSS, are in the process of being accepted, state by state. However, most science teachers are unfamiliar with the new standards, and the Engineering Design component may be even more problematic. This poster presents a formative evaluation of a high school science faculty's preparedness to teach Engineering Design. Science teachers were asked to respond to survey and interview items that reflected their Passion for Science = PS, processes of Science Inquiry in their classroom = SI, processes of Engineering Design in their classroom= EnD, and familiarity with NGSS and the Engineering Design component of the NGSS = FAM. A corresponding survey of students was also undertaken. In general, teachers have a high PS, a high SI, lower on EnD, and lower on FAM. Teachers have valid suggestions and concerns for their preparation for Engineering Design and NGSS.

Iowa Science Teaching Section
Oral Presentations

76. ENVIRONMENTAL ISSUES INSTRUCTION (EII), STEM AND NGSS: MULTIDISCIPLINARY TEACHING

Iowa Central Community College, April 11 & 12, 2014
Environmental issues instruction (eii) provides teachers with an opportunity to teach about local environmental problems and issues in an interdisciplinary manner. It allows students to make connections with problems and issues in their own communities and examine possible solutions. Examples of how teachers have implemented this will be provided using the theme, Preserving and Protecting Our Water Resources. This multidisciplinary instructional model will be explained along with the integration of science, technology, engineering, and mathematics (STEM) and the Next Generation Science Standards (NGSS).

Organismal Biology Section
Poster Presentations

77. WNT PATHWAY DISRUPTORS CAUSE DUPLICATION OF AXIS IN NEMATOSTELLA VECTENSIS
Madelyne Besack, John Greavees, and Jacqueline Brittingham
Simpson College

*Nematostella vectensis*, the starlet sea anemone, is a novel model organism that demonstrates surprisingly complex mechanisms for controlling cell fate and body plan through highly conserved genetic pathways. The expression profile of the Wnt genes in *Nematostella* following gastrulation and early planula development implies that they play an important role in gastrulation and axial patterning. We hypothesize that Wnt pathway disruptors, alsterpaullone (ALS) and anandamide (AEA), will perturb normal cellular interactions during gastrulation, and axis specification. Protocols for spawning were developed in our lab to obtain viable eggs that were synchronously fertilized, and then treated with ALS and AEA. We employed the use of mRNA localization techniques and cellular markers for cytoskeletal actin along with morphometric analysis to characterize gene expression profiles and tissue organization in these embryos. We determined the dose at which ALS and AEA disrupted morphogenesis, axis specification and caused ectopic oral poles to form in *Nematostella*. These studies provide additional insights into the embryology of this unique model organism, and a better understanding of the role of the Wnt pathway in directing development in *Nematostella vectensis*.

Organismal Biology Section
Oral Presentations

78. TEMPORAL AND TEMPERATURE-BASED REPRODUCTIVE ISOLATION OF THREE GENETIC LINEAGES IN THE SUNFLOWER MAGGOT FLY, STRAUZIA LONGIPENNIS
Jarod Armenta and Maren Elnes
Cornell College

Insects constitute a large share of biodiversity and as such may provide key information on mechanisms that lead to speciation. In particular, lineages that occupy the stages between interbreeding populations and reproductively isolated species may reveal reproductive barriers important in speciation. *Strauzia longipennis*, the sunflower maggot fly, has recently been shown to harbor three distinct genetic lineages. All three lineages of *S. longipennis* occur sympatrically, and court and mate on the same plant - Jerusalem artichoke (*Helianthus tuberosus*). Such a situation provokes speculation as to what barriers to gene flow maintain genetic differentiation between the three lineages. Here, we use phenological and morphological data collected throughout a field season to test
the hypothesis that the three lineages of *S. longipennis* experience temporal and/or temperature-based reproductive isolation. Over the summer of 2013 we captured adult *S. longipennis* flies from *H. tuberosus* and took note of gender, temperature and time of capture, wing pattern, and thorax type. Once data collection was finished, we analyzed male abundance using single and two-degree Celsius intervals and one- and two-hour temporal intervals for each lineage. Because morphological characters can only be used to sort males into the three genetic lineages (vittigera, typica, or longitudinalis), females of *S. longipennis* were not included in this analysis. We did not find support that the three *S. longipennis* lineages experience temporal reproductive isolation. Males separated by temperature intervals showed three disdistinct peaks of abundance at 21, 25, and 30 degrees Celsius, yet when we broke apart the overall sample and analyzed temperature-based abundance for separate lineages, this trend proved nonsignificant. These results suggest some promising trends and recommend that females from this collection be sorted into lineages using genetic markers in order to obtain larger sample sizes.

79. RECOMBINATION RATES IN CHROMOSOME 5 OF *DROSOPHILA AMERICANA*: IS THERE EVIDENCE FOR NATURAL SELECTION?

Rachel Conelly, Abigail Thomas, and Paulina Mena
Central College

Geographically distributed polymorphisms suggest the presence of natural selection in response to variable climate. Chromosomal inversions are a common polymorphism that have been associated with natural selection. Their hypothesized role is to capture and protect alleles beneficial in a certain environment by preventing recombination in heterozygotes. *Drosophila americana* is an excellent model for examining the involvement of genome organization in facilitating local adaptation because of its large number of chromosomal polymorphisms. In particular, it has two inversions on the fifth chromosome. Although evidence suggests recombination between these two inversions should be common, it is not observed in wild populations. We hypothesize that natural selection is favoring certain arrangements, while others are inviable in the wild. In this study, we perform crosses of *D. americana* lines each with one inversion of chromosome five to test if recombination between these inversions occurs in the lab. If all possible chromosomal types are seen, then it can be deduced that factors in their natural habitat are responsible for the lack of recombinants in the wild. Both cytological and molecular genetics methods are used to determine recombination rates in the F2 offspring of the lab crosses.

80. DIVERSITY AND EFFECT OF ENDOPHYTIC FUNGI ON IOWA PRAIRIE GRASSES

Kimberly Howell and Eric J. Baack
Luther College

Tallgrass prairies are an important ecosystem of the Midwest, but the fungal symbionts, which live inside prairie grasses and often confer benefits to their hosts, such as drought tolerance, have received little study. We isolated endophytes from native and restored prairies in northeast Iowa to compare the difference of the species of endophytes isolated from the native grasses in each prairie. We also set up a greenhouse experiment in which Indian Grass seedlings were inoculated with no endophytes, with one of two endophyte strains, or with both endophytes after being heat treated to remove any pre-existing endophytes. Some of the fungi isolated from the field have yet to be classified. In the greenhouse experiment, the effects of fungi on their hosts varied depending on the species, with one species appearing to increase plant growth and another appearing to decrease plant growth. Fundamental biological questions remain unanswered for these important symbionts of a keystone prairie species.
81. PHOTOMETRIC AND SPECTROSCOPIC MEASUREMENTS SUPPORTING THE MODEL OF AN ECLIPSING BINARY STELLAR SYSTEM FOR 68 HERCULIS
Kenneth W. McLaughlin, and Janak Panthi
Loras College
We have differential photometric measurements of 68 Her that show repeating, regularly periodic minima in its apparent magnitude consistent with a previously reported period of variable brightness. Our spectroscopic measurements indicate that Doppler-shifts in its spectrum vanish at the minima in this light-curve indicative of an eclipsing binary-motion transverse to our line of sight; absorption lines attributed to our atmosphere show no such variation thereby supporting the significance of our measured Doppler-shifts. Our spectroscopy covers a limited wavelength region that includes a strong hydrogen H-alpha 656.3 nm absorption line and weaker helium 667.8 nm absorption. At near-maximum Doppler-shift for the suspected orbital motion we have been able to resolve the presence of the Ha line in both binary partners although one partner clearly dominates while we were unable to resolve such splitting in the weaker helium line.

82. STUDIES OF STAR FORMATION REGIONS IN THE MILKY WAY GALAXY
Steven R. Spangler and Allison H. Savage
University of Iowa
Stars form from gas in the space between stars in our Galaxy (the interstellar medium). Once they form, some of these stars produce intense ultraviolet radiation that ionizes the gas in their vicinity and heats it, causing it to expand into the undisturbed gas. The astronomical term for these ionized regions is HII regions. The hottest and most luminous stars also produce intense winds that can exceed the power in the solar wind of our Sun by almost ten orders of magnitude. These powerful winds evacuate cavities in the interstellar medium called stellar bubbles. Finally, the most massive stars detonate as supernovas after a few million years, sending shock waves through the interstellar medium. These processes, singly and together, cause stars to heavily modify the medium from which they form. We are in a program to better understand these processes by measuring important physical parameters of the HII regions and stellar bubbles such as electron density and the vector magnetic field. Our measurements are made with radio telescopes, specifically the Very Large Array of the National Radio Astronomy Observatory. We observe background radio sources behind the HII regions and stellar bubbles, and measure the effect of these objects on the radio waves. Our technique of choice is measurement of Faraday rotation, a rotation in the plane of polarization of radio waves when the radio waves propagate through an ionized gas possessing a magnetic field. We have excellent results on an HII region called the Rosette Nebula, which is a paradigm for stellar bubbles. From our data, we have inferred that the magnetic field is modified and amplified by the bubble structure. In this poster, we will also present a general review of our knowledge of HII regions and stellar bubbles.

83. COMPARING SUPER KAMIOKANDE ATTENUATION LENGTH TO PROPOSED HYPER KAMIOKANDE DETECTOR
Karl James Ahrendsen¹, Chris Walter², Alex Himmel², and Tarek Aziri²
Buena Vista University¹, Duke University²
The highly successful Super Kamiokande Water Cherenkov detector has a proposed big brother, Hyper Kamiokande. In order to ensure that building Hyper Kamiokande will be of benefit to the...
physics community, simulations must be run on
the detector. These simulations will help to deter­ al
mine what physical events it will be sensitive to and how large the detector will be built. The attenuation of light in these detectors is of particular interest to determine how many dividing walls are necessary for the Hyper K detector. Through sim­ulations in WCSim, a program developed from the GEANT4 framework, the attenuation of light is shown to be comparable to Super K, if not a little longer. This serves as evidence that Hyper K as it is currently designed will be an effective tool for studying neutrino physics.

84. PERTURBATIONS TO THE NEUTRINO MIXING WITH COMPLEX PHASES
Jiajun Liao¹, Danny Marfatia ², and Kerry Whis­nant¹
Iowa State University¹, University of Hawaii at Manoa²
We extend the study of small perturbations on Majorana neutrino mass matrices from real to complex cases. We derive analytic formulas for the corrections to both the mixing angles and Di­rac CP phase. We find the corrections to the mixing angle \( \theta_{12} \) and Dirac CP phase \( \theta_D \) can be very large. This suggests that the underlying unperturbed mixing angle \( \theta_{12} \) and Dirac CP phase need not to be close to the experimentally preferred value. We also study the charged lepton corrections.

85. NANO-PHOTONIC ORGANIC SOLAR CELL AR­CHITECTURE FOR ADVANCED LIGHT TRAPPING WITH DUAL PHOTONIC CRYSTALS
Akshit Peer and Rana Biswas
Iowa State University
It is critical to achieve broad band harvesting of solar photons to enhance the efficiency of thin film solar cells. Organic solar cells have shown remarkable progress recently, but still only absorb less that 50% of the solar spectrum. P3HT-PCBM cannot effectively absorb red photons (\( \lambda > 600 \) nm) and deep blue photons (\( \lambda < 480\)nm) because of long photon absorption lengths in these wave­length ranges. Similarly, the absorption of pho­tons is very weak in PTB7 beyond 700 nm. To in­crease the broad band absorption of light, we de­sign periodically textured organic solar cells that can be experimentally realized. These periodic structures strongly diffract light resulting in wave­guide modes, and in addition demonstrate plas­monic concentration of light. We utilize rigorous scattering matrix simulations where Maxwell’s equations are solved vectorially. Our optimum nano-photonic solar architecture consists of multiple photonic and plasmonic crystals. The cathode is periodically textured with a periodic array of na­noparticles that both strongly diffracts light and generates plasmonic concentration of light inten­sity. In addition there is a polymer lens on the glass side that focuses light on the nanoparticles at the absorber layer cathode interface, and enhances further the plasmonic effects. This nano-photonic architecture with pitch 500 nm leads to very large absorption enhancements of 48% and current en­hancements of 56% relative to the flat cell, with the usual 100-190 nm P3HT-PCBM thicknesses. The absorption and photo-current approach the Lambertian limit. This architecture is experimentally feasible since it does not require spin coating on corrugated surfaces. Moreover patterning the organic layer before cathode deposition has been demonstrated in recent experiments and lens ar­rays on glass are routinely developed. This archi­tecture is a unique way to control the interaction of light with nanostructures, and has the potential to achieve >12% efficient single junction organic solar cells.

86. TRANSITION PROBABILITIES AND EQUATIONS OF MOTION OF OPERATORS
Kuo-Ho Yang
St. Ambrose University
Consider an atomic system interacting with an external classical electromagnetic radiation field. We use \( W \) to denote a hermitian operator and assume that its eigenfunctions form a complete basis set of the Hilbert space. The wavefunction of the atomic system is then expanded in the complete set of the orthonormal eigenfunctions of \( W \), result­ing in expansion coefficients. We show that the transition probabilities of these expansion coeffi­cients are directly proportional to \( dW/dt \), the time rate of change of the operator \( W \). We study the
consequences of several operators including the relativistic and non-relativistic unperturbed Hamiltonian (sum of the canonical kinetic energy operator and static Coulomb potential energy), the total Hamiltonian, and the energy operator (the sum of the mechanical kinetic energy operator and static Coulomb potential energy). We argue that, based on Poynting's theorem in electrodynamics, the most logical and physical choice is to use the eigenfunctions of the energy operator, not the unperturbed Hamiltonian nor the total Hamiltonian, to calculate the occupation probabilities and the transition probabilities.

87. THERE'S SOMETHING IN THE WATER: EFFECTS OF ENDOCRINE DISRUPTING CHEMICALS (EDCS) ON OFFSPRING VIABILITY IN ADULT ZEBRA FINCHES, TAENIOPYGIA GUTTATA

Aubrey Lambach, Kristin Dahlem, Rebecca Rabideaux, Rebekah Reynolds, Ann Den Hartog, Avery Tucker, and Debora Christensen
Drake University

Endocrine disrupting chemicals (EDCs), including bisphenol-A (BPA), are found in nearly all plastics and many naturally-occurring plant-derived substances. EDCs act by mimicking the effects of estrogen or testosterone, and even plastic containers that are considered food safe have been shown to release estrogen-like chemicals into their contents. In mammals, fetal exposure to BPA leads to lower birth weight, changes in accessory reproductive gland development, alterations in sexual differentiation in the brain, and altered social behaviors. Elevated EDC levels have also been found in obese children and obesity itself can result in earlier onset of puberty. Our study sought to investigate the complex relationship between exposure to EDCs, body weight, onset of puberty, and reproductive success in adulthood. In order to study this, we administered drinking water to breeding adult zebra finches via BPA-positive and BPA-negative plastic bottles. Animals in our negative control received water from a glass bottle and animals in our positive control received estrogen-supplemented (0.25 nmol/g body weight/animal) water from a glass bottle. Preliminary results show no effect on overall egg production, but decreased egg viability (p < 0.0001), low chick hatch weight (p < 0.0001), and reduced survivability in animals exposed to estrogen and estrogenic compounds through daily water consumption. Despite no correlation between individual body weight at hatch and weight at fledge, offspring from the negative control treatment tended to fledge at a slightly younger age, yet weighed more at fledge (p = 0.0046).

88. THE EFFECT OF A WATER AEROBICS EXERCISE REGIME ON FUNCTIONAL MOBILITY

Delia Salomon, Matt Schaeffer, and Liz Queathem
Grinnell College

The purpose of this study was to determine if a water aerobics exercise regime is as effective as a walking exercise regime in the maintenance and improvement of functional mobility. Eighteen participants age 41 and up were recruited from the Grinnell community. Ten chose to take part in the water aerobics intervention and 8 participated in a walking intervention. The water aerobics intervention met bi-weekly for thirteen sessions. Sessions lasted 45 minutes. The participant’s functional mobility was assessed by initial and final measurements of the functional reach test (FRT) and the timed-up-and-go test (TUG). Additionally, participants were asked to fill out the SF-36 survey. The SF-36 survey was scored out of 100 for eight different categories. The type of exercise did not significantly impact the participant’s performance on the tests. Additionally, at the end of the 13 sessions participants did not perform significantly better than they did during their initial test. The SF-36 revealed that there was potential for improvement in mood and mental well-being. There was a significant improvement in score for the energy level category. All of the other categories, except for those addressing role limitations,
participants did not perform significantly better than they did during their initial test. The SF-36 revealed that there was potential for improvement in mood and mental well-being. There was a significant improvement in score for the energy level category. All of the other categories, except for those addressing role limitations, demonstrated a mean increase in score, although it was not statistically significant. Both types of exercise may be beneficial for the maintenance of mobility, but people who self-select for exercise studies may already be exercising enough that they see diminishing returns from adding two more exercise sessions per week. A regular exercise program may still yield improved well-being even if it does not significantly affect the measures of functional mobility that we used in our study.

89. POLYMORPHISM OF HUMAN DIABLO GENE AND ITS COMPARATIVE EXPRESSION IN NORMAL AND CANCER TISSUES

Paige M. Triervieler, and Rasika G. Mudalige-Jayawickrama
University of Dubuque

Apoptosis (programmed cell death) is an extremely important function in the life (or end of life) of any given human body cell, particularly in embryonic development. Apoptosis promotes the differentiation of cells and tissues in a developing embryo by removing some embryonic tissues and allowing other tissues to develop in their place (Deveraux and Reed, 1999). In apoptosis, the caspase enzyme is released into the cytosol of the cell from the mitochondria and starts the cascade of dismantling the cell ultimately resulting in cell death. The proteins known as IAPs (Inhibitor of Apoptosis Protein) bind to various caspases and inhibit the progression of cell death to prevent the untimely death of normal cells (Deveraux and Reed, 1999). The gene we were interested in, the Smac/DIABLO gene, binds to IAPs and reduces the binding of IAPs to the caspase enzyme. The binding of the DIABLO gene to IAPs allows caspas- ses to be released from the inhibitory effect of IAPs, resulting in the promotion of apoptotic processes (Martinez-Ruiz and others, 2008). The primary focus of this project are to isolate the DIA- BLO gene from different people in order to compare the allelic variations found within a popula-
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