

2013


Proceedings of the 125th Annual Meeting of the Iowa Academy of Science [Program, 2013]

Iowa Academy of Science

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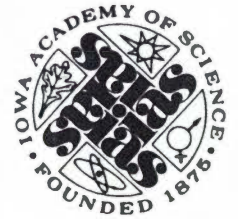
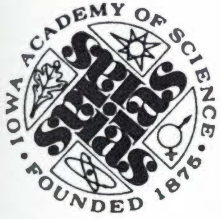
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PROCEEDINGS OF THE 125TH

ANNUAL MEETING

OF THE

IOWA ACADEMY OF SCIENCE



SIMPSON COLLEGE

April 19-20, 2013
Indianola, Iowa

FRIDAY SCHEDULE

Time	Events	Location	Page
7:30	IJAS Registration	Kent Campus Center (KCC), 1 st Floor Atrium	3
8:00	Registration Desk Opens	KCC, 1 st Floor Atrium	3
8:00	Silent Auction begins	KCC, Principal Black Box	3
8:00-10:30	Morning Snack	KCC, Principal Black Box	
8:00-10:45	IJAS Competition Posters	KCC, Black Box Mezzanine	6
8:00-10:45	IJAS Competition Presentations	KCC 218, 101/102, & Student Senate; McNeill Pioneer Conference	6
10:00-	EPIC-AIMS Reception	KCC, Principal Black Box	9
11:00-11:55	General Session I	KCC, Hubbell South	7
Noon-1:15	IJAS Award Luncheon	KCC, Hubbell North	8
1:30-2:15	Science at Simpson—IJAS Event	Carver Science Hall, Atrium	9
1:30-2:15	IAS Business Meeting	KCC, Principal Black Box	8
2:30-3:30	Student Programs Committee Meeting	KCC, Student Senate	
2:30-4:30	Symposia	See Symposium desc.	12-15
4:30	Senior Poster Session Begins	KCC, Principal Black Box & Black Box Mezzanine	16-19
4:45-6:00	Social Hour	KCC, Principal Black Box	20
6:00-7:30	President's Banquet	KCC, Hubbell North	20
7:45-8:45	General Session II	KCC, Hubbell South	21

Book Store: Friday and Saturday, KCC, Principal Black Box
 Iowa NSF EPSCoR Booth: Friday and Saturday, KCC, Principal Black Box
 Silent Auction: Friday and Saturday Morning, KCC, Principal Black Box

SATURDAY SCHEDULE

Time	Events	Location	Page
8:00	Registration Desk Opens	Kent Campus Center (KCC), 1 st Floor Atrium	3
8:00-10:30	Morning Snack	Kent Campus Center (KCC), Principal Black Box	
8:20-10:45	Section Meetings	See Section Schedules	26-31
11:00-Noon	General Session III	KCC, Hubbel South	22
Noon-1:15	ESTA Award Luncheon	KCC, Hubbell North	23
1:00-3:00	Pick up IJAS Auction Items	KCC, 1 st Floor Atrium	3
1:15-5:00	Section Meetings Continue	See Section Schedules	26-31
1:00	Geological Society of Iowa Field Trip	Meet at large parking lot west of KCC for 1:00 depart.	24
2:00	Tour of Kemin Industries—Preregistration	Be at Kemin at 2:00	24
1:30—3:00	Leading Place Based Investigations—Water Special Symposium	McNeill, Room 110	25
2:30—3:30	Tri Beta Award Ceremony	KCC, Principal Black Box	25

Registration Desk Hours

Friday — 8:00 a.m.-Noon and 1:15 p.m.-5:00 p.m.

Saturday — 8:00 a.m.-Noon and 1:00 p.m.-4:00 p.m.

Pick-up Silent Auction items between 1:00 & 3:00 p.m., Saturday



Lost?

See the map on the inside back cover or stop by the registration desk for assistance.

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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
the American Association for the Advancement of Science
(AAAS),
the National Science Teachers Association (NSTA),
National Association of Biology Teachers (NABT),
the American Junior Academy of Sciences (AmJAS),
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:

Simpson College, John W Byrd, President
Jackie Brittingham, Conference Host

Central Iowa Presbyterian Association on Science,
Technology, and the Christian Faith and Iowans for
Religion and Science Dialogue; Co-sponsors of John
Haught

Catherine Swoboda, General Session III
World Food Prize, General Session III
John Weis, General Session I
NASA Marshall Space Flight Center, General Session I
Lynn Brant, Symposium A
Mike Lazere, Iowa NSF EPSCor Symposium B
Bob Watson, Symposium C
National Weather Service, Des Moines, Symposium C
Kemin Industries
The Geological Society of Iowa

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

2012 Corporate Members

Platinum

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Bronze

BMC Aggregates, L. C.



Welcome

to the 125th Annual Meeting of the
Iowa Academy of Science.

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IOWA JUNIOR ACADEMY

Posters-KCC Principal Black Box, Presentations-KCC 218, 101/102, Student Senate; & McNeill Pioneer Conference

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 for this year's competition with the stipulation that IAS must raise an additional \$8,000 or more to add to an IJAS Endowment fund. Your purchases at the IJAS Auction are a part of that match.

Iowa Delegates & Alternates to the 2013 AmJAS

Delegates:

Maddie McMinn, Ames High School (now at Glenwood High School)
Paolo Adajar, Central Lee High School

Alternates:

Lupe MacIntosh, Ames High School
Aparna Ajjarapu, Ames High School

2012-2013 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 21 grants to the following awardees:

- Adam Elder
- Alex Gurganus
- Alison Dickinson
- Ben Popken
- Ben Sulzberger
- Breanna Kramer
- Brooke Metcalf
- Burhan Syed
- Daniel Andreotti
- Hannah Hartmann
- Jonah DeGeest
- Kate Murray
- Kelsey Bryant
- Lane Campbell
- Luke Fernando
- Macy Vollbrecht
- Mattie Kupfer
- Max Wei
- Micaela Bryant
- Michaela Wheatley
- Michelle Hu
- Nathan Chen
- Padmashree Rajagopalan
- Paolo Adajar
- Ramon Libarnes
- Seongwoo Shin
- Truman Meyer

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 2013 Delegates:

Maya Amjadi, Cedar Falls High School
Adam Zaccone, Harlan Community High School

Iowa's 2013 Alternates: Macy Murray, Keokuk High School; Dylan Beyhl, North High School, Davenport; Eva Shelton, Williamsburg High School; Megan Valentine, Dubuque Senior High School



GENERAL SESSION I

Friday, 11:00 a.m., Kent Campus Center, Hubbell South

Life Support on the International Space Station

Jennifer Pruitt

Aerospace Engineer

Environmental Control and Life Support Group

Marshall Space Flight Center

Huntsville, Alabama



NASA has been working to put mankind in space for over 50 years, and we're still working to further our own exploration. Exciting things are happening for space exploration as programs develop. These programs include a new heavy lift rocket to transport equipment to an eventual base on the moon, Mars or an asteroid and the investigation of Mars by the recently landed Curiosity rover. The International Space Station (ISS) with over 10 years in space continues its work as an in-orbit science habitat.

The Environmental Control and Life Support Systems (ECLSS) group at the Marshall Space Flight Center in Huntsville, AL has been developing and sustaining systems to keep astronauts healthy and comfortable while they live in space. There are several aspects of maintaining a livable environment: temperature, humidity, waste, storage, air, and water.

The two most prominent factors are providing clean air and water. The ISS currently has several sorbent-based air purification systems to extract carbon dioxide and other potential toxins from the air, and other systems that split carbon dioxide and water molecules to replenish the oxygen in the cabin. The Water Recovery System was launched to the ISS to recycle the water supply on the ISS instead of constantly resupplying the entire stock. Technologies such as these have allowed us to safely explore new frontiers.

About Jennifer Pruitt

Even with a love for math, Jennifer Pruitt originally planned to be a musical theater major in college. It wasn't until her junior year of high school that she was introduced to engineering, when her physics teacher brought in a student from Drexel University to speak. After that, becoming an engineer and working for NASA became her new dream. Originally from Scranton, PA, she obtained her Bachelors of Science in Mechanical Engineering from Pennsylvania State University in 2009. Jennifer Pruitt now works for the Environmental Control and Life Support (ECLS) group at NASA's Marshall Space Flight Center in Huntsville, AL. Jennifer daily analyzes and trends data sent from the ISS and is the engineering point of contact to make sure the system is operating properly.



IJAS AWARD LUNCHEON

Friday, Noon, Kent Campus Center, Hubbell North

Luncheon Program

Iowa's 2012 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, 2014

Iowa Alternates to the American Junior Academy of Science, 2014

IJAS \$500 Senior Scholarships

Recognition of all IJAS Members, Judges, and Sponsors

IAS BUSINESS MEETING

Friday, 1:30-2:15 p.m., McAllister Hall (MH), 104G

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
- James Colbert, Iowa State University
- John Pearson, Iowa Department of Natural Resources
Executive Director Annual Report
Discussion
New Business
Adjournment

Necrology

April 2012—Present

Charles Remington Estee, August 2012
David Blum, October 2011
David Robinson, February 2012
Dorothy M. Schlensig Baringer, February 2012
Harold P. Bechtoldt, October 2001
Howard M. Lenhoff, July 2011
Larry J. Clark, October 2011
Melvin H. Brown, September 2012
Verner Jensen, September 2011

SPECIAL EVENTS

Friday

EPIC-AIMS Reception

Friday, 10:00 a.m., Kent Campus Center, Principal Black Box

The teacher educators who form EPIC-AIMS come together to support one another around issues unique to private colleges. The group supports the goals of increased science and math teacher quantity and quality in Iowa by providing a venue for (1) sharing ideas related to private college issues, (2) facilitating collaborations among interested members, and (3) advocacy within the state around issues unique to the private colleges. EPIC-AIMS invite everyone interested in these goals to share ideas at this reception.

Science at Simpson—IJAS Event

Friday, 1:30-2:15, Carver Science Hall Atrium

You are invited to an "Open House" in Carver Science laboratories where the Biology, Neuroscience, Chemistry, Physics, Computer Science and Mathematics programs will highlight the tools and techniques that our Simpson students employ every day in our research facilities. High school students, teachers and other participants at the 125th Annual Meeting of the Iowa Academy of Science can partake in laboratory demonstrations and other interactive simulations presented by science students and faculty from the Division of Natural Science at Simpson College. Come and see what Science at Simpson is all about!

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

Math & Science Fall Conference 2013

October 22-23, 2013

in Ames, Iowa!

Learn more about the
Iowa Science Teaching Section activities:

www.iacad.org/ists



IAS VOLUNTEERS

2012 to 2013 Section Chairs and Vice Chairs

Mark Anderson	Anthropology Section Chair
Vacant	Anthropology Section Vice Chair
Alesia Hruska-Hageman	Cellular, Molecular & Microbiology Section Chair
Stephanie Toering Peters	Cellular, Molecular & Microbiology Section Vice Chair
Ned Bowden	Chemistry Section Chair
Vacant	Chemistry Section Vice Chair
Cindi Boyd	Community College Biologists Section Chair
Vacant	Community College Biologists Section Vice Chair
Ted Wilson	Ecology and Conservation Section Chair
John Pearson	Ecology and Conservation Section Vice Chair
Albert Ratner	Engineering Section Chair
Thomas Rudolphi	Engineering Section Vice Chair
Melinda Coogan	Environmental Science & Health Section Chair
Kavita Dhanwada	Environmental Science & Health Section Vice Chair
Chad Heinzl	Geology Section Chair
Teri Wiese	Geology Section Vice Chair
De Anna Tibben	Iowa Science Teaching Section Chair
Eric Hall	Iowa Science Teaching Section Vice Chair
Sara Sheeley	Organismal Biology Section Chair
Vacant	Organismal Biology Section Vice Chair
Lisa Mellmann	Physics, Atmospheric & Space Sciences Section Chair
Vacant	Physics, Atmospheric & Space Sciences Section Vice Chair
Rasna Sabharwal	Physiology and Health Sciences Section Chair
Harald Stauss	Physiology and Health Sciences Section Vice Chair

**Thank You
Volunteers**

IAS VOLUNTEERS

2012 to 2013 Committee Members

Committees on Committees and Elections

Liaison – Gale Vermeulen, Chair & Liaison

(2013) Paul Mayes
(2013) Yvette McCulley
(2014) Chad Fields
(2014) DeAnna Tibben
(2015) Alicia Schiller
(2015) Nick Stoyhoff

Membership Committee

Liaison – Karen Breitbach

(2013) Tammie Atchison
(2013) Scott Figdore, Chair
(2014) Matt McAndrew
(2014) Chris O'Connell
(2015) Gary Fulton
(2015) Rasika Mudalige

Conservation and Preserves Committee

Liaison – John Pearson

(2013) Gary Phillips, Chair
(2013) Rebecca Christoffel
(2014) Lee Burras
(2014) Doug Karlen
(2015) Rick Hall
(2015) Yvette McCulley

Recognition and Awards Committee

Liaison – Kavita Dhanwada

(2013) Rick Lampe, Chair
(2013) Karen Wignall
(2014) Paul Mayes
(2014) Clinton Meyer
(2015) Carol Boyce
(2015) Mary Lestina

Finance Committee

Liaison – Chad Heinzl

(2013) Jeff Weld
(2013) Daryl Smith, Chair
(2014) Peter van der Linden
(2014) Pat Finnerty
(2015) Andrew Brittingham
(2015) Jeanne Rogis

Societal Issues Committee

Liaison – Tom Rosburg

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

Iowa Science Foundation Committee

Liaison – Ray Anderson

(2013) Stephanie Toering Peters, Chair
(2013) Rhawn Denniston
(2014) Ryan L. Rehmeier
(2014) Johanna Foster
(2015) Alison Beharka
(2015) Tom Fenton

Student Programs Committee

Liaison – Mahdi Al-Kaisi

(2013) Mario Affatigato
(2013) Kelen Panec, Chair
(2014) Heidi Peterson
(2014) Todd Tracy
(2015) Muhammad Spocter
(2015) Felicitas Avendano

2013 ESTA Committee

Tom Ervin, Chair
Ernie Schiller
Mike Zeller
Gasaway, Kimberly
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, McNeill, Pioneer Conference Room

Overlapping Magisteria

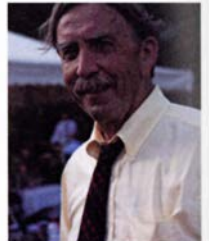
- Dr. John F. Haught, Senior Research Fellow, Woodstock Theological Seminary, Georgetown University
- Dr. Loyal Rue, Emeritus Professor of Religion, Luther College
- Dr. Jerome P. Soneson, Head of Department, Associate Professor of Religion, University of Northern Iowa

In a memorable article and then a book, *Rocks of Ages*, Stephen Jay Gould argued that the two great magisteria of religion and science, do not overlap. He says they deal with different questions about human existence. However, there is much evidence that the two magisteria do indeed overlap. If religion (small "r") is regarded in its broadest sense then it does affect science and certainly science has affected how people think about religion. The purpose of this symposium is to explore that overlap.



John Haught, Roman Catholic theologian and senior Fellow at Woodstock Theological Center at Georgetown University, who has spoken and written extensively about science and religion will share his thoughts on these overlapping magisterial. Learn more about Dr. Haught on page 21.

Loyal Rue, whose ideas regarding religion are almost the opposite of John Haught's, will provide a viewpoint from a religious perspective that does not need a supernatural god. Dr. Rue has held visiting fellowships at the University of Hartford, Durham University, Nottingham University, and Harvard University. Professor Rue has published articles and books advocating Religious Naturalism and exploring the implications of evolutionary psychology for the disciplines of philosophy and religion. His book, *By the Grace of Guile*, was selected as a New York Times Notable Book of 1994. Since then he has published *Everybody's Story*, *Religion is not about God*, and *Nature is Enough*.



Jerry Soneson received his doctorate at Harvard in the Study of Religion under Gordon Kaufman. His published materials have been in the area of religious pluralism, American philosophical pragmatism, environmental ethics, and theological historicism. His book, *Pragmatism and Pluralism: The Theological Significance of John Dewey*, is an attempt to provide a methodology for theological reflection in a world of multiple and competing religious traditions. In other publications he has been particularly interested in articulating a picture of religious faith that is meaningful and viable in the contemporary world, particularly in light of the methods, assumptions and results of contemporary social and natural sciences and historical studies.

SYMPOSIUM B

Friday, 2:30-4:30, Carver Science Hall, Room 215

Iowa NSF EPSCoR: Establishing Iowa as a leader in Renewable Energy

- Raghu Mudumbai, Assistant Professor, University of Iowa
- Melissa Ward, University of Iowa
- Dr. Mark Mba Wright, Assistant Professor, Iowa State University



The Wind Energy Platform of the EPSCoR Project, Raghu Mudumbai

This presentation will focus on the Smart Grids plank. This plank is investigating various aspects of the design of the next generation electric grid, specifically how smart grid technologies can be used to efficiently integrate wind power generation into the electric grid.



Raghu Mudumbai joined the Electrical & Computer Engineering department at the University of Iowa in August 2009 as Assistant Professor. He obtained his B. Tech in EE from the Indian Institute of Technology, Madras, India in 1998; MSEE from the Polytechnic University, Brooklyn in 2000 and PhD in ECE from the University of California, Santa Barbara in 2007. He also worked as a Systems Engineer at LM Ericsson Telephone Company between 2001 and 2003. His research interests are in wireless communications and power systems.

Energy Utilization and Efficiency Platform of the EPSCoR Project, Melissa Ward

This presentation focuses on the development of research infrastructure across Iowa by using existing school buildings as research instruments to investigate building energy utilization. Analyzing structures, identifying which technologies should be applied, and understanding the impact of human behavior on overall facility performance are key factors in optimizing energy efficiency. By integrating occupant participation into the research, the platform aims to gain a holistic understanding of all the parameters that jointly increase efficiency of existing buildings.



Melissa M. Ward has a diverse background as a consulting engineer working on various projects including environmental pollution control, geotechnical design, and construction monitoring. She received her B.S. in Civil Engineering from Michigan Technological University in 2006. Her professional experience led to her interests in natural resource management and its social impacts. She's finishing her master's degree in rural sociology from Pennsylvania State University while working as a Research Associate in the College of Engineering at the University of Iowa. Melissa is passionate about engaging communities in engineering projects and research. Melissa works on the Building Sciences plank of the Energy Utilization Platform of the Iowa NSF EPSCoR project.

Iowa NSF EPSCoR: Establishing Iowa as a leader in Renewable Energy continued...

Bioenergy Platform of the Iowa EPSCoR Project, Mark Mba Wright



The Iowa EPSCoR Bioenergy Platform is an interdisciplinary program focused on expanding Iowa's research capacity in biomass sustainability and conversion technology. The program, led by Robert C. Brown from Iowa State University, supports a growing group of faculty at all three Iowa Regent institutions. Faculty members contribute both research and service through partnerships with private colleges.

Mark Mba Wright received his bachelor's degree in Mechanical Engineering at Iowa State University. Following graduation, he pursued graduate degrees under the supervision of Robert C. Brown. Mark received degrees in the Mechanical Engineering and Biorenewable Resources and Technology program at Iowa State University. In 2011, Mark started a Post-Doctoral Research Associate position at the Massachusetts Institute of Technology under the supervision of Yuriy Román-Leshkov and William H. Green. Mark is currently an Assistant Professor in the Department of Mechanical Engineering at Iowa State University.

SYMPOSIUM C

Friday, 2:30-4:30, Kent Campus Center, Hubbell South

Climatological, Geologic, and Social Implications of Drought

- Craig Cogil, Senior Meteorologist with the National Weather Service, Des Moines
- Robert Libra, State Geologist of Iowa
- William Stowe, CEO and General Manager, Des Moines Water Works

This symposium will cover the 2012 drought from three perspectives discussing the short and long term impact of drought and the impacts on society.

Climate Perspectives of the 2012 Drought, Craig Cogil



The 2012 drought across Iowa and much of the Central United States has been considered one of the worst droughts in the past half century. The impacts were widespread and had significant regional and in places, severe local implications. In events such as these, it is often useful to provide context to see how it lies in comparison with other extreme events and where it stands in comparison to normal. The presentation will look at variety of recent hydrological and meteorological information from Iowa and place it into a historical perspective.

Craig Cogil earned a BS in Meteorology from Iowa State University in 1994 and started as an operational meteorologist for the NWS that same year in Waterloo, Iowa. His varied experience within the NWS includes being program leader for NWS computing systems, the WSR-88D Doppler Radar and most recently the Climate Program. He has worked extensively with the severe weather databases for Iowa and has developed tornado, wind, hail, and flash flood climatology for the state. In addition, he has worked with local and state officials in developing historical information databases or providing climate information to assist in decision support.

Iowa's Water Supplies: Drought and Beyond, Robert Libra

Bob will discuss the effect of the current drought on our surface water and ground water resources and how the drought's water impacts compare to those in the past. Highlights include how demand for water has changed since the last major drought. Beyond the water issues that dry weather results in, we will discuss the status of our deep groundwater sources; these are not susceptible but face the problem of long-term over-use.

Bob Libra has worked with the Iowa Geological and Water Survey since 1982. His work at the Survey has involved a wide range of geologic, hydrologic, land use, and water-quality investigations. In addition, he has provided technical assistance on water resources, water quality, waste disposal, and environmental geology to state and local governments, and to Iowa citizens and businesses. He has degrees in Geology from the University of Wisconsin at Superior and Indiana University. In 1999 he became supervisor of the Survey's Groundwater and Environmental Geology program, and in 2003 was appointed State Geologist of Iowa.



Immersed in Water, Bill Stowe

Immersed in Water emphasizes the central role water has in each of our lives, beginning before birth and throughout our entire lives, at individual, community and economic levels. Special attention will be placed on water as a vital component in our economic development, history as a city and our community's future. An appreciation for the challenges faced in both water quality and water quantity will underscore the active role each of us as individuals play in promoting greater stewardship of water in its many forms. Participants will be encouraged to be both better informed consumers of water and also more engaged actors in the discussions necessary to improve our water resources as a community.



Bill Stowe graduated from Grinnell College with a Bachelor of Arts and received a Master of Science in Engineering from the University of Wisconsin, a Master of Science in Industrial Relations from the University of Illinois, and a Juris Doctorate Degree from Loyola University Law School. DMWW is a regional utility that protects public health by delivering outstanding quality water in reliable quantities. DMWW works closely with business, environmental and agricultural leaders to advocate for better stewardship of water resources and leads clean water initiatives throughout Central Iowa.



Des Moines River at Fort Dodge

POSTER SESSION

Friday, 4:30 p.m., Kent Campus Center, Principal Black Box

Anthropology Section

1. POWER OF THE PEOPLE: A SAMPLE OF ENVIRONMENTAL ETHOS IN NORTH SUMATRA AND JAKARTA

Cellular, Molecular & Microbiology Section

4. IDENTIFICATION OF HUMAN HOST PROTEINS THAT INTERACT WITH SWINE INFLUENZA A VIRUS NUCLEOPROTEIN USING THE YEAST TWO-HYBRID SYSTEM^{BBB & ISGC}
5. TOWARD THE CHARACTERIZATION OF ESSENTIAL HERPESVIRUS INTERACTIONS
6. SCREENING FOR *LISTERIA* MUTANTS WHICH LYSE WITHIN THE HOST CYTOPLASM^{BBB}
7. MOLECULAR ANALYSIS OF INCOMPATIBILITY GROUPS FROM CONJUGALLY-TRANSFERRABLE *SALMONELLA* PLASMIDS
8. INSERTIONAL MUTAGENESIS OF A HEPATOTOXIN SYNTHASE GENE IN *MICROCYSTIS AERUGINOSA*
9. PROTEIN PURIFICATION OF RNS1 FOR FUNCTIONAL CHARACTERIZATION^{BBB}
10. SQUASH THAT INHIBITION: POLYPLOIDY IN PRAIRIE PLANTS
11. CAN RETARGETED ONCOLYTIC MEASLES VIRUS BY-PASS NEUTRALIZING MONOCLONAL ANTIBODIES?
12. MOLECULAR DYNAMICS SIMULATIONS OF THE THERMOSOME, A GROUP II CHAPERONIN: ROLE OF WATER IN PROTEIN FOLDING
13. HUMAN CYTOMEGALOVIRUS RESISTANCE TO DEOXYRIBOSYLINDOLE NUCLEOSIDES MAPS TO A POINT MUTATION IN THE TERMINASE SUBUNIT ENCODED GENE UL89
14. SUBCELLULAR LOCALIZATION OF CONSTRUCTED TUMV NIA-PROTEASE MUTANTS
15. DECREASES IN HERPES SIMPLEX VIRUS 1 AND 2 REPLICATION BY THE TELOMERASE INHIBITOR MST-312
17. DEFECTS OF SIR2 AND SIR3 DEACETYLASES INCREASE YEAST RESISTANCE TO BORIC ACID^{ISF}
18. PHENOTYPIC ANALYSIS OF RIBONUCLEASE AND AUTOPHAGY MUTANTS RELATED TO RIBOSOME TURNOVER

Chemistry Section

33. MONOGLYCERIDES-BASED THERMO-RESPONSIVE LOCAL DRUG DELIVERY SYSTEMS
34. ARE GENERICS FROM ACROSS THE BORDER SAFE
35. PROGRESS TOWARDS THE SYNTHESIS OF TRANS-AVICENNOL
36. DESIGNING A DNA ORIGAMI SELF-ASSEMBLED STRUCTURE
37. DETERMINATION OF HARMALA ALKALOIDS IN THE MINT FAMILY
38. REMOVING CONTAMINANTS FROM OIL USING MAGNETIC ARRAY FILTRATION
39. SYNTHESIS OF PALLADIUM-NACNAC COMPLEXES FOR USE IN HETEROGENEOUS CATALYSIS
40. SYNTHESIS OF DICHLORODI-P-TOLYLITIN, A PRECURSOR OF SUBSTITUTED W-SN COMPOUNDS
41. OPTIMIZATION OF PEPTIC DIGESTION AND HYDROGEN/DEUTERIUM EXCHANGE FOR LIQUID CHROMATOGRAPHY MASS SPECTROMETRIC ANALYSIS OF PROTEINS
42. CHEMICAL STABILITY ENHANCEMENT OF NIFEDIPINE IN MONOGLYCERIDES-MATRICES

POSTER SESSION

Friday, 4:30 p.m., Kent Campus Center, Principal Black Box

Ecology & Conservation Section

51. MANAGEMENT OF NON-NATIVE, INVASIVE *PASTINACA SATIVA* (WILD PARSNIP) USING MULTIPLE CONTROL METHODS
52. *PARAMECIUM CAUDATUM* POPULATIONS AFTER EXPOSURE TO *TYPHA LATIFOLIA* OR *LYTHRUM SALICARIA*
53. A SURVEY OF TREES AND TREE HEALTH AT THE WEST UNION RECREATION COMPLEX
54. THE RELATIONSHIPS BETWEEN SPECIES RICHNESS AND BOTH REMNANT SIZE AND LEAFY SPURGE INVASION IN WINONA GOAT PRAIRIES^{BBB}
55. COMPETITIVE ABILITIES OF NATIVE AND INVASIVE SPECIES IN THE MOJAVE DESERT
56. IMPACT OF BT CORN LEAF DETRITUS ON AQUATIC MACROINVERTEBRATES
57. SEASONAL VARIATION IN OSTRACOD POPULATIONS IN A NORTHWESTERN IOWA FEN
58. ASSESSING THE GENETIC DIVERSITY OF REDISCOVERED *AEGLA* CRABS OF PARAGUAY USING RAPD ANALYSIS
59. A SURVEY OF TREE DIVERSITY IN THE VOLGA RIVER STATE RECREATION AREA
60. POPULATION DYNAMICS AND HYBRIDIZATION OF *ICTOBIUS* SPECIES IN STRAIGHT SLOUGH, MISSISSIPPI RIVER, POOL 6^{BBB}
61. THE EFFECT OF EASTERN REDCEDAR ON SOIL PROPERTIES IN A NORTHWEST IOWA PRAIRIE
62. ANALYZING THE POTENTIAL FOR INBREEDING AND OUTBREEDING DEPRESSION IN BUTTERFLY MILKWEED (*ASCLEPIAS TUBEROSA*) ON IOWA NATIVE PRAIRIES^{ISF}
63. LICHEN BIODIVERSITY IN SOUTHEAST IOWA
64. HOME RANGE, HABITAT USE, AND MORTALITY OF HATCHLING AND JUVENILE ORNATE BOX TURTLES (*TERRAPENE ORNATA ORNATA*) IN IOWA
65. FEEDING PREFERENCES OF *ANAS PLATYRHYNCHOSIS* COLLECTED DURING MIGRATION NEAR SWEET MARSH WILDLIFE MANAGEMENT AREA, IOWA
66. OBSERVATIONS OF SUMMER TRICHOPTERAN POPULATIONS IN A DROUGHT STRICKEN LAKE IN NORTHWESTERN IOWA
67. A SURVEY OF TREE SPECIES IN ECHO VALLEY STATE PARK
68. DOES EUROPEAN BUCKTHORN AFFECT THE DISTRIBUTION OF ANURANS IN A GALLERY FOREST
69. WIND AND GEESE AS VECTORS FOR ZOOPLANKTON DISPERSAL: HOW MANY ZOOPLANKTON DOES IT TAKE TO START A COLONY^{BBB}

Engineer Section

83. A CFD APPLICATION TO SCALE-UP A FREE-FALL REACTOR
84. IMPROVING THE QUALITY OF BIOMASS-DERIVED PYROLYSIS OILS WITH AN AUGER REACTOR
85. FLEX FUEL POLYGENERATION: OPTIMIZING COST, SUSTAINABILITY, AND RESILIENCY
86. NUMERICAL MODELING OF PYROLYSIS PROCESS WITHIN AUGER REACTOR
87. A COMPACT VERSATILE MICROBIAL FUEL CELL FROM PAPER
88. COST-PRODUCTION IMPACT OF INCREASING WIND TURBINE TOWER HEIGHT

POSTER SESSION

Friday, 4:30 p.m., Kent Campus Center, Principal Black Box

Environmental Science & Health Section

97. THE EFFECTS OF *IN UTERO* EXPOSURE TO ATRAZINE ON THE HEMATOPOIETIC SYSTEM IN *MUS MUSCULUS*^{BBB}
98. TOXICOLOGICAL IMPACTS OF ROAD-SALT CHLORIDES IN A URBAN AND RURAL AREA OF THE MISSISSIPPI WATERSHED

Geology Section

108. TEMPORAL VARIATIONS OF NITRATE IN MUNICIPAL WELL WATER IN CEDAR FALLS, IOWA

Iowa Science Teaching Section

113. APPLYING INQUIRY-BASED LEARNING TO ANATOMY & PHYSIOLOGY LABORATORIES
114. USING THE YEAST TWO-HYBRID (Y2H) SYSTEM AS A CLASS PROJECT TO TEACH UPPER LEVEL MOLECULAR BIOLOGY

Organismal Biology Section

117. THE ANALYSIS OF DIFFERING H₂O AMOUNTS ON THE EFFECTIVENESS OF AQUACOAT AND ZEBRA ON THE GERMINATION TIME OF *POA PRATENSIS* VAR. *BARDUKE*
118. ROADSIDE-SURVEY OF NORTH AMERICAN BADGER EXCAVATIONS IN NORTHWESTERN IOWA
119. SOYBEAN APHIDS INCREASE CALLOSE DEPOSITION NEAR SIEVE PLATES OF APHID-RESISTANT SOYBEAN PLANTS
120. DETERMINING THE EFFICACY OF EMBARK AND PRIMO MAXX ON INHIBITING *POA ANNUA* VAR. *REPTANS* IN *AGROSTIS STOLONIFERA* WHILE MAINTAINING AESTHETIC QUALITY OF *AGROSTIS STOLONIFERA*
121. MODIFICATION OF SOYBEAN FATTY ACID LEVELS BY SOYBEAN APHIDS IS MAINLY A LOCAL RESPONSE
123. INVESTIGATIONS IN OPTIMAL FORAGING OF FOX SQUIRREL (*SCIURUS NIGER*) IN NORTHWESTERN IOWA

Physics, Atmospheric & Space Science Section

130. PROBING THE SOLAR CORONA WITH RADIO ASTRONOMY
131. FORMATION AND CHARACTERIZATION OF ALKALI ORTHOBORATE CRYSTALS
132. REMOTE SENSING MEASUREMENTS OF CORONAL MASS EJECTIONS
133. MULTIPERIODIC PULSATING VARIABLES IN THE FIELD OF OPEN CLUSTER M23
134. CLASSIFYING ABRUPT SIGNAL CHANGES
135. THE ROLE OF NONCLASSICAL TWO-PHOTON EFFECTS IN INTERFERENCE OF TWO ATTENUATED LASER BEAMS^{ISF}
136. MARSIS PROJECT

POSTER SESSION

Friday, 4:30 p.m., Kent Campus Center, Principal Black Box

Physiology & Health Science Section

141. OVERCOMING TOLERANCE TO TRANSCUTANEOUS ELECTRICAL NERVE STIMULATION BY MODULATING FREQUENCY
142. FOOTBALL SHOE HEIGHT INFLUENCES PROPRIOCEPTION WITHOUT AFFECTING RANGE-OF-MOTION OR PERFORMANCE WHEN ATHLETES' ANKLES ARE TAPED AND SPATTED
143. SOMATOSENSORY PERCEPTION OF RUNNING SHOE MASS
144. EFFECTS OF BODY POSITION AND ARM ON BLOOD PRESSURE RECORDINGS IN MALES
145. DIAGNOSING AND EVALUATING THE PRESENCE OF MRSA ON A NORTHWEST IOWA COLLEGE CAMPUS
146. A DIFFERENT TAKE ON THE AMES TEST: TESTING NATURAL AND PHARMACEUTICAL CANCER THERAPIES ON *C. ELEGANS* WITH CANCER PHENOTYPES
147. EFFECTS OF IVERMECTIN ON THE DEVELOPING HYPOTHALAMUS OF MAMMALS
148. THE ANTIBODY RESPONSE OF *MUS MUSCULUS* WHEN VACCINATED IN THE PRESENCE OF ACUTE ENVIRONMENTAL STRESSORS^{βββ}
149. THE EFFECTS OF TOY ENRICHMENT VERSUS EXERCISE ENRICHMENT ON NON-SPATIAL WORKING MEMORY IN FEMALE *MUS MUSCULUS*^{βββ}
150. ELECTROMYOGRAPHICAL ANALYSIS OF LOWER BODY MUSCLES DURING THE BACK SQUAT WHEN ANKLES ARE BRACED OR TAPED
151. TWO EXPERIMENTS SUGGESTING BENZOPHENANTHRIDINE ALKALOIDS, THE CLASSICALLY-RECOGNIZED BIOACTIVE MOLECULES FROM BLOODROOT, MAY NOT FULLY EXPLAIN OBSERVED IMMUNOMODULATORY PROPERTIES OF BLOODROOT EXTRACTS^{ISF}
152. THE EFFECTS OF CHOCOLATE ON EXERCISE BENEFITS IN RATS
153. FOOT TEMPERATURE DURING TREADMILL RUNNING IN COTTON VS. SYNTHETIC ATHLETIC SOCKS^{βββ}
154. CARDIOVASCULAR RESPONSES TO A COLD WATER STIMULUS: A COMPARISON BETWEEN SWIMMERS AND NON-SWIMMERS^{βββ}
155. MOLECULAR MODEL OF SALIVA AND DENTAL PELLICLE: EXAMINING INTERACTIONS RESPONSIBLE FOR PLAQUE FORMATION^{βββ}
156. BIOTHERAPEUTICS USAGE BY IOWA PHARMACISTS: A SURVEY

Tri-Beta Posters List

Numbers 4, 6, 9, 54, 60, 69,
97, 148, 149, 153, 154, 155
are Tri-Beta posters, identified
By ^{βββ} after the title and a
gold ^{βββ} sign above the poster.



SOCIAL HOUR

Friday, 4:45 p.m., Kent Campus Center, Principal Black Box

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

Be sure to visit the Senior Poster Presentations.



2011 Poster Session. M. Seavey

PRESIDENT'S BANQUET

Friday, 6:00 p.m., Kent Campus Center, Hubbell North

President Tom Ervin presiding

Program

Dinner

Welcome and Introductions, Craig Johnson, Executive Director

Executive director Remarks

125th Annual Meeting Recognition

President's Address by Tom Ervin

New Fellow Recognition

- James Colbert, Iowa State University

- John Pearson, Iowa Department of Natural Resources

Presentation of Incoming President's Gavel by Tom Ervin

Incoming President's Address by Gale Vermeulen

Closing Remarks



Tom Ervin, IAS President



GENERAL SESSION II

Friday, 7:45 p.m., Kent Campus Center, Hubbell South

Science and the Question of Cosmic Purpose

John F. Haught

Senior Research Fellow

Woodstock Theological Center

Georgetown University

Washington, DC



Is it still possible in an age of science to believe that the universe has an overarching meaning or purpose? This lecture will ask why scientifically educated people today often see the cosmos as “pointless,” and then it will propose several ways in which science may be thought of as compatible with religious belief that something of lasting significance is working itself out in the universe.

Co-sponsored by Iowans for Religion and Science Dialog, the Iowa Academy of Science, and the Presbyterian Association on Science, Technology, and the Christian Faith.

About John F. Haught

John F. Haught lectures internationally on science and religion and draws on the best of contemporary theology to better understand the sometimes tense and controversial relationship between the two. He is currently focused on Teilhard de Chardin’s vision for the twenty-first century. Haught has a distinguished career of nearly four decades teaching theology at Georgetown University and was awarded the degree of Doctor *Honoris Causa* by the University of Louvain in 2009. He has authored a long list of books, testified for the plaintiffs in *Kitzmiller et al. vs. Dover Board of Education* (the Intelligent Design Trial) and has won numerous awards including the Owen Garrigan Award in Science and Religion (2002), the Sophia Award for Theological Excellence (2004), and a Friend of Darwin Award from the National Center for Science Education (2008).



GENERAL SESSION III

Friday, 11:00 a.m., Kent Campus Center, Hubbell South

Will Climate Change Decrease Agriculture's Ability to Feed the World?

Jerry L. Hatfield, Ph.D.

Laboratory Director

USDA-ARS-National Laboratory for Agriculture

and the Environment

Ames, Iowa



Agriculture has evolved under a changing climate in all areas of the world. Production levels of all commodities have steadily increased; however, there is variation in production among years induced by variations in the weather within a growing season. Agricultural production is dependent upon temperature and precipitation as the two key factors affecting growth and development. Each plant has a specific temperature range for growth and development and exposure to temperatures outside of that range limits productivity. Precipitation is the primary source of water for agriculture and without water, plants like all living organisms die. It is important to realize that temperature and water are important environmental factors for livestock, insects, diseases, and weeds and increased variation in these two factors will affect all organisms.

An important feature in climate change is the increasing variability and seasonality in temperature and precipitation. Across the Midwest, there has been an increase in spring precipitation and storm intensity which has caused more runoff, erosion, and degradation of the soil resource. Increases in minimum temperatures during the growing season have affected both plant growth and animal response more than the changes in the mean temperature. Warmer nighttime temperatures hasten plant development and reduces yield and livestock productivity. To cope with climate change and increase agriculture's ability to feed the world, we need to understand the interactions among the different components in agricultural systems and their response to climate. We can meet the challenge of feeding the world but we need to address this challenge with a view toward understanding how the agricultural system interfaces with the climate.

About Jerry L. Hatfield

Dr. Jerry L. Hatfield is the Laboratory Director of the USDA-ARS National Laboratory for Agriculture and the Environment in Ames, Iowa. He received his Ph.D. from Iowa State University in 1975 in the area of Agricultural Climatology and Statistics, a M.S. in Agronomy from the University of Kentucky in 1972, and B.S. from Kansas State University in Agronomy in 1971. He was appointed Laboratory Director of the National Soil Tilth Laboratory in 1989 which was renamed to the National Laboratory for Agriculture and the Environment in 2009. His personal research focuses on quantifying the interactions among the components of the soil-plant-atmosphere system to quantify resilience of cropping systems to climate change. He has served in numerous roles representing agriculture on the National Climate Assessment, member of the IPCC process that received the 2007 Nobel Peace Prize, and Lead Author on an IPCC Special report on the Effects of Climate Extremes.

ESTA AWARD LUNCHEON

Noon, Saturday, April 20th, 2013



2013 ESTA Awards

Earth/Space/Environmental Science

Troy D. Schwemm

Southeast Polk High School, Pleasant Hill

Elementary Education

Lisa Chizek

North Tama Elementary, Traer

General/Multiple Science

Matthew J. Stier

City High School, Iowa City

Life Science

Kacia Ann Cain

Central Campus, Des Moines

Middle/Junior High Science

Sue Sparrow Meggers

Interstate 35 School, Truro

Physical Science

Matthew Joseph Harding

West High School, Iowa City

Excellence in Science Teaching 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. ESTA Winners demonstrate, through knowledge and practice, the characteristics of an exemplary educator. Awardees receive a plaque and a \$200 award.

FIELD TRIPS

Saturday



Geological Society of Iowa Field Trip

Pennsylvanian Exposures in the White Breast Recreation Area of Marion County

Join Iowa's geologists on a 3 hour excursion into the spectacular scenery of the White Breast Recreation Area on Lake Red Rock just north of Knoxville. Exposures include a thick sequence of sediments deposited in an estuary about 309 million years ago and clearly display multiple layers of cyclic tidal deposition.

It was then deeply incised by a large river that deposited a thick package of sandstone which forms a 100 foot bluff above the waters of Lake Red Rock. The trip will depart the Simpson College campus from the large parking lot to the west of the Kent Campus Center at 1:00 pm. Guidebooks will be available at a nominal price. Travel is via personal vehicles.



Kemin Industries Tour

By Pre-Reservation Only—

Saturday afternoon— 2:00 pm. Meet at Kemin Industries. Maps will be provided at the Registration Desk.

Kemin Industries was founded in 1961 and is headquartered in Des Moines. Using cutting edge molecular technology, Kemin manufactures more than 500 specialty ingredients used by the feed and food industries and the health, nutrition and beauty markets. Kemin has seven divisions and operates in more than 90 countries and impacts the lives of more than 1.4 billion people throughout the world every day. Participants will tour the Kemin innovation center as well as one of its manufacturing facilities. Sign up when you register online or contact the IAS office at 319-273-2021 to reserve your spot. Travel is by personal vehicles. Maps will be available at the registration desk.

National Balloon Museum & Ballooning Hall of Fame

Tour the National Balloon Museum & Ballooning Hall of Fame at your leisure. The museum provides a comprehensive understanding of ballooning and its history through its exhibitions and collections. The facility archives more than 200 years of ballooning and its history while hosting over 5,000 visitors from 20 countries each year. General Admission is \$3 for visitors over 12. Children are free. Hours in April are 1:00—4:00 pm daily. Location: 1601 N. Jefferson Way (Highway 65/69 North) in Indianola.

SPECIAL EVENTS

Saturday

Leading Place-based Student Investigations



Leading Place-based Student Investigations—Water

1:30-3:00 p.m., Saturday, McNeill, 110

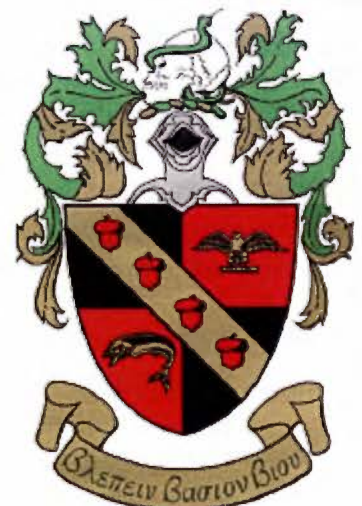
Leading Place-based Student Investigations—Water is a professional development course originally designed by the Iowa Academy of Science and Iowa Department of Natural Resources Aquatic Education Program. Participants, Upper Elementary through High School grade teachers from across Iowa, and their students have spent the semester designing a water related research project about an issue that is important to their community. Course instructors will discuss the course structure and objectives. The teachers and some of their students will present their student investigation projects and results. Time will be set aside for an informal discussion with participants.

Tri-Beta Award Ceremony

2:30-3:30 p.m., Saturday, Kent Campus Center, Principal Black Box

βββ (TriBeta) is a society for students, particularly undergraduates, dedicated to improving the understanding and appreciation of biological study and extending boundaries of human knowledge through scientific research. Since its founding in 1922, more than 200,000 persons have been accepted into lifetime membership, and more than 553 chapters have been established throughout the United States and Puerto Rico.

Every other year the regional βββ meet with the Iowa Academy of Science at the IAS Annual meeting. βββ member poster and oral presentations will be presented with the Academy sections and judged for awards given out during this ceremony.



SECTION MEETINGS

See individual sections for room and schedule.

Anthropology Section

8:20-11:00, McNeill, Room 106 (with Anthropology Section)

- 8:20 109. EXPLORATION FOR PLATINUM GROUP ELEMENT MINERALIZATION IN NORTHEAST IOWA
- 8:40 110. SURFICIAL GEOLOGY OF THE HUDSON QUADRANGLE BLACK HAWK COUNTY, IOWA
- 9:00 111. DETERMINING THE PROVENANCE OF BUILDING MATERIALS FROM A PROTO-URBAN ELYMIAN SETTLEMENT AT THE BASE OF MONTE POLIZZO (WESTERN SICILY)
- 9:20 112. DETERMINING THE PROVENANCE OF BUILDING MATERIALS USED BY THE ELYMIAN CULTURE FROM THE SUMMIT OF MONTE POLIZZO, SICILY
- 9:40 2. ARCHAEOLOGICAL INVESTIGATIONS AT ERB TANKS ROCKSHELTER, A MIDDLE AND LATER STONE AGE SITE IN THE CENTRAL NAMIB DESERT OF NAMIBIA
- 10:00 3. IOWA'S BATS AND THE TENNIS RACQUET: HOW ETHNOGRAPHY OF PUBLIC OPINION CAN ASSIST BIOLOGISTS, ECOLOGISTS, FIELD RESEARCHERS, AND OTHER SCIENTISTS
- 10:20 Section Business Meeting: Election of New officers & new Business
- 11:00 General Session III—Will Climate Change Decrease Agriculture's Ability to Feed the World? , Kent Campus Center, Hubbell South

Cellular, Molecular & Microbiology Section

8:20-4:15, Carver Science Hall, Room 231

- 8:20 19. THE ANTIBACTERIAL EFFECT OF THE GOGGLE SANITIZER^{BBB}
- 8:40 20. THE EFFECTS OF ETS-RELATED TRANSCRIPTION FACTOR 81 OVEREXPRESSION ON LUNG DEVELOPMENT IN *XENOPUS LAEVIS* FROGS^{BBB}
- 9:00 21. THE EFFECT OF OVER-EXPRESSION OF TBX2 ON EPIREGULIN EXPRESSION IN MCF-10A CELLS^{BBB}
- 9:20 22. MUTAGENIC EFFECT OF PROSCAR (FINASTERIDE) ON HUMAN CULTURED PERIPHERAL BLOOD LYMPHOCYTES USING SISTER CHROMATID EXCHANGE^{BBB}
- 9:40 23. USING FLUORESCENCE MICROSCOPY TO EXAMINE IODIDE UPTAKE BY THE HUMAN SODIUM IODIDE SYMPORTER
- 10:00 24. USE OF RED FLUOROPHORES TO STUDY CELL MIGRATION AND PROGRAMMED CELL DEATH IN LIVING *DROSOPHILA* EMBRYOS
- 10:20 Section Business Meeting: Election of New officers & new Business
- 11:00 General Session III—Will Climate Change Decrease Agriculture's Ability to Feed the World? , Kent Campus Center, Hubbell South
- 1:15 25. ANTIBIOTICS INFLUENCE THE DISTRIBUTION OF MITOCHONDRIA IN HUMAN CELLS
- 1:35 26. SUSCEPTIBILITY OF *PROPIONIBACTERIUM ACNES* TO ANTIBIOTICS AND PA6 PHAGE
- 1:55 27. EFFECTIVENESS OF TWO PHAGES AGAINST COMMUNITY-ACQUIRED METHICILLIN-SUSCEPTIBLE AND METHICILLIN-RESISTANT *STAPHYLOCOCCUS AUREUS* ISOLATES
- 2:15 28. DEVELOPING RESOURCES TO IDENTIFY THE EFFECTS OF GRAVITY ON INFLUENZA A VIRUS REPLICATION^{ISGC}
- 2:35 Break

SECTION MEETINGS

See individual sections for room and schedule.

Cellular, Molecular & Microbiology Section Continued

8:20-4:15, Carver Science Hall, Room 231

- 2:55 29. CHARACTERIZING DUAL INFECTION AND SUPERINFECTION INHIBITION BY TWO ALPHAHERPESVIRUSES IN A NATURAL HOST WITH SCANNING CONFOCAL MICROSCOPY AND TRANSMISSION ELECTRON MICROSCOPY
- 3:15 30. DEGRADATION AND UTILIZATION OF COMPLEX CARBOHYDRATES BY *TRICHOMONAS VAGINALIS*^{ISF}
- 3:35 31. AN EXAMINATION OF AN INC A/C PLASMID IN *SALMONELLA TYPHIMURIUM*, AND ITS EFFECTS ON FITNESS AND INVASION
- 3:55 32. GENOME-WIDE SCREENING REVEALS CONTRIBUTION OF HISTONE H2A EXCHANGE TO BA SENSITIVITY IN *SACCHAROMYCES CEREVISIAE*

Chemistry Section

8:40-2:55, McNeill, Room 107

- 8:40 43. BETTER BUILDING BLOCKS FOR BIGGER DNA ORIGAMI
- 9:05 44. AROMATIC ORGANOSULFATES IN AMBIENT AEROSOL
- 9:30 45. IDENTIFICATION OF ATMOSPHERIC AEROSOL SOURCES IN IOWA CITY
- 9:55 46. SEPARATION OF FATTY ACIDS USING NANOPOROUS MEMBRANES
- 10:20 Section Business Meeting: Election of New officers & new Business
- 11:00 General Session III—Will Climate Change Decrease Agriculture's Ability to Feed the World? , Kent Campus Center, Hubbell South
- 1:15 47. IONIC CONDUCTIVITY STUDIES OF LiBOB-BASED 1ND2/1NM2 ELECTROLYTES FOR LITHIUM-ION BATTERY APPLICATIONS
- 1:40 48. THE TRANSPORT OF IONIC SPECIES IN SILYL SOLVENTS BY NMR SPECTROSCOPY
- 2:05 49. SYNTHESIS OF 4-PHOSPHO-METHYL GLUCOSE
- 2:30 50. SYNTHESIS OF 4-PHOSPHO-MALTOSE

Community College Biologists

1:15-4:00, McNeill, Room 106

- 1:15 Section Business Meeting: new business and planning meeting

SECTION MEETINGS

See individual sections for room and schedule.

Ecology & Conservation Section

8:20-4:35, Carver Science Hall, Room 215

- 8:20 70. EFFECT OF VEGETATION DIVERSITY AND STRUCTURE ON THE COMMUNITY STRUCTURE OF SMALL MAMMALS WITHIN GRASSLANDS^{BBB}
- 8:40 71. WHAT AN URBAN PRAIRIE CAN TEACH US
- 9:00 72. BISON-MEDIATED SEED DISPERSAL IN A TALLGRASS PRAIRIE RECONSTRUCTION^{ISF}
- 9:20 Break
- 9:40 73. A MODEL OF INVERTEBRATE RICHNESS ON RESTORED PRAIRIES
- 10:00 74. PRAIRIE POWER: ARE SPECIES-RICH PRAIRIE RECONSTRUCTIONS AN IDEAL FEEDSTOCK FOR BIOENERGY
- 10:20 Section Business Meeting: Election of New officers & new Business
- 11:00 General Session III—Will Climate Change Decrease Agriculture's Ability to Feed the World? , Kent Campus Center, Hubbell South
- 1:15 75. THE EFFECT OF PERIGYNIA REMOVAL AND STRATIFICATION ON GERMINATION AND FIELD EMERGENCE OF *CAREX BREVIOR* AND *C. MOLESTA*
- 1:35 76. INHIBITORY EFFECTS OF *ACER SACCHARUM* ROOT EXTRACT ON THE GROWTH OF *RHAMNUS CATHARTICA*^{BBB}
- 1:55 77. COMPARING MACROINVERTEBRATE ASSEMBLAGES IN IOWA HEADWATER STREAMS THAT DIFFER IN SEVERITY OF AGRICULTURAL IMPACTS^{BBB} & ^{ISF}
- 2:15 78. ARTIFICIAL BANK STABILIZATION'S IMPACT ON THE MACROINVERTEBRATE POPULATION
- 2:35 Break
- 2:55 79. PREPARING FOR THE ADVANCE OF WHITE-NOSE SYNDROME IN IOWA^{BBB}
- 3:15 80. RED-BACKED VOLES (*MYODES GAPPERI*) IN WINNEBAGO COUNTY, IOWA: PRELIMINARY RESULTS
- 3:55 81. WILL WOLVES RETURN TO IOWA
- 4:15 82. DO HYDRIC CONDITIONS DURING EMBRYONIC DEVELOPMENT IN THE FIELD INFLUENCE PHENOTYPES OF NEONATAL REPTILES

Engineering Section

10:20-4:15, McNeill, Room 108

- 10:20 Section Business Meeting: Election of New officers & new Business
- 11:00 General Session III—Will Climate Change Decrease Agriculture's Ability to Feed the World? , Kent Campus Center, Hubbell South
- 1:15 89. BIO-OIL DEOXYGENATION THROUGH CATALYTIC FAST PYROLYSIS IN A FLUIDIZED BED REACTOR
- 1:55 90. NUMERICAL MODELING OF UREA INJECTION AND NO EMISSION IN A STOKER BOILER
- 2:15 91. CELLULOSE-HEMICELLULOSE, CELLULOSE-LIGNIN INTERACTIONS DURING FAST PYROLYSIS
- 2:35 92. BIOMASS PYROLYSIS AND GASIFICATION OF DIFFERENT BIOMASS FUELS
- 2:55 93. PARTIAL OXIDATIVE PYROLYSIS OF RED OAK USING A LAB-SCALE FLUIDIZED BED REACTOR
- 3:15 94. MOISTURE IMPACT ON PAPER SLUDGE GASIFICATION
- 3:35 95. MEASURING TRACE COMPONENTS IN SYNGAS USING GAS CHROMATOGRAPHY AND ION CHROMATOGRAPHY
- 3:55 96. CHARACTERIZATION OF BIOMASS PRODUCER GAS GENERATION IN BIOMASS GASIFICATION

SECTION MEETINGS

See individual sections for room and schedule.

Environmental Science & Health Section

8:20-2:15, Carver Science Hall, Room 340

- 8:20 99. REPRODUCTION IN FEMALE *MUS MUSCULUS* EXPOSED TO ATRAZINE *IN UTERO*^{BBB}
- 8:40 100. EFFECTS OF *IN UTERO* EXPOSURE TO ATRAZINE ON IMMUNE CELL FUNCTION IN MICE^{BBB}
- 9:00 101. CHARACTERIZATION OF ATMOSPHERIC AEROSOLS IMPACTED BY THE IOWA CITY LANDFILL TIRE FIRE
- 9:20 102. CHEMICAL COMPOSITION OF ATMOSPHERIC AEROSOLS IN IOWA CITY
- 9:40 103. SEASONAL AND SPATIAL VARIATIONS AND SOURCE APPORTIONMENT OF FINE PARTICULATE MATTER IN IOWA
- 10:00 104. OVIPOSITION SITE PREFERENCE IN MEDIA WITH AND WITHOUT CADMIUM IN DIFFERENT STRAINS OF *DROSOPHILA MELANOGASTER*
- 10:20 Section Business Meeting: Election of New officers & new Business
- 11:00 General Session III—Will Climate Change Decrease Agriculture's Ability to Feed the World? , Kent Campus Center, Hubbell South
- 1:15 105. EFFECTS OF TRICLOSAN ON ZEBRAFISH METABOLISM
- 1:35 106. METOLACHLOR INHIBITS HUMAN ALVEOLAR CELL GROWTH
- 1:55 107. EFFECT OF DEFORESTATION ON MICROBIAL BIODIVERSITY WITHIN THE AMAZON RAINFOREST AND THE PRESENCE OF POTENTIAL NOVEL ACTINOMYCETES

Geology Section

8:20-11:00, McNeill, Room 106 (with Anthropology Section)

- 8:20 109. EXPLORATION FOR PLATINUM GROUP ELEMENT MINERALIZATION IN NORTHEAST IOWA
- 8:40 110. SURFICIAL GEOLOGY OF THE HUDSON QUADRANGLE BLACK HAWK COUNTY, IOWA
- 9:00 111. DETERMINING THE PROVENANCE OF BUILDING MATERIALS FROM A PROTO-URBAN ELYMIAN SETTLEMENT AT THE BASE OF MONTE POLIZZO (WESTERN SICILY)
- 9:20 112. DETERMINING THE PROVENANCE OF BUILDING MATERIALS USED BY THE ELYMIAN CULTURE FROM THE SUMMIT OF MONTE POLIZZO, SICILY
- 9:40 2. ARCHAEOLOGICAL INVESTIGATIONS AT ERB TANKS ROCKSHELTER, A MIDDLE AND LATER STONE AGE SITE IN THE CENTRAL NAMIB DESERT OF NAMIBIA
- 10:00 3. IOWA'S BATS AND THE TENNIS RACQUET: HOW ETHNOGRAPHY OF PUBLIC OPINION CAN ASSIST BIOLOGISTS, ECOLOGISTS, FIELD RESEARCHERS, AND OTHER SCIENTISTS
- 10:20 Section Business Meeting: Election of New officers & new Business
- 11:00 General Session III—Will Climate Change Decrease Agriculture's Ability to Feed the World? , Kent Campus Center, Hubbell South

SECTION MEETINGS

See individual sections for room and schedule.

Iowa Science Teaching Section

8:30-3:00, McNeill, Room 110

- 8:30 CALL TO Order
- 8:40 115. PUBLIC EDUCATION AND WILDLIFE MANAGEMENT
- 9:00 ISTS PAST PARTICIPANT REVIEW DISCUSSION WITH GOVERNORS STEM ADVISORY COUNCIL ADMINISTRATIVE OFFICE
- 9:20 116. THE ROLE OF A RESIDENT SCIENTIST IN A HIGH SCHOOL SCIENCE CLASSROOM FROM THE PERSPECTIVES OF A GK-12 FELLOW AND A HIGH SCHOOL TEACHER
- 9:40 Break
- 10:00 Section Business Meeting: Election of New officers & new Business
- 11:00 General Session III—Will Climate Change Decrease Agriculture's Ability to Feed the World? , Kent Campus Center, Hubbell South
- 1:30 Leading Place-based Student Investigations—Water Symposium with Iowa DNR

Organismal Biology Section

9:20-2:15, Carver Science Hall, Room 312

- 9:20 124. CHEMICAL ANALYSIS OF METAPLEURAL TISSUE IN THE WESTERN THATCHING ANT, *FORMICA OBSCURIPES*^{BBB}
- 9:40 125. MODELING MOISTURE CONTENT IN MAIZE KERNELS AS A LATENT VARIABLE FOR BIOCHEMICAL REACTION RATE
- 10:00 126. EFFECTS OF WNT DISRUPTORS ON *NEMATOSTELLA VECTENSIS* DEVELOPMENT^{BBB & ISF}
- 10:20 Section Business Meeting: Election of New officers & new Business
- 11:00 General Session III—Will Climate Change Decrease Agriculture's Ability to Feed the World? , Kent Campus Center, Hubbell South
- 1:15 127. VARIATION IN BAT COMMUNITIES IN EASTERN IOWA^{BBB}
- 1:35 128. MOVEMENT AND HABITAT USE OF PADDLEFISH IN MISSISSIPPI RIVER POOL 5A^{BBB}
- 1:55 129. VIBRATIONAL SIGNALING MEDIATES INTER-MALE AGONISTIC INTERACTIONS IN THE COOK STRAIT GIANT WETA (*DEINACRIDA RUGOSA*)

SECTION MEETINGS

See individual sections for room and schedule.

Physics, Atmospheric & Space Science Section

8:40-10:40, McNeill, Room 108

- 8:40 137. NOVEL TECHNIQUES FOR GLASS CHARACTERIZATION AND MANUFACTURING: TIME OF FLIGHT MASS SPECTROMETRY AND AEROLEVITATION
- 9:00 Break
- 9:20 138. SPECTRAFIT: A NEW PROGRAM TO FIT ^{10}B NMR POWDER PATTERNS AUTOMATICALLY
- 9:40 139. POYNTING'S THEOREM IN ELECTROMAGNETIC THEORY VERSUS INTERACTION HAMILTONIAN IN QUANTUM MECHANICS
- 10:00 140. GLASS FORMING LIMITS: A SIMPLE MODEL BASED ON SHORT-RANGE STRUCTURAL UNITS
- 10:20 Section Business Meeting: Election of New officers & new Business
- 11:00 General Session III—Will Climate Change Decrease Agriculture's Ability to Feed the World? , Kent Campus Center, Hubbell South

Physiology & Health Science Section

8:40-2:15, Carver Science Hall, Room 205

- 8:40 157. EVENING PRIMROSE (*OENOTHERA BIENNIS*) SEED EXTRACT, INCREASES THE FORCE AND FREQUENCY OF CONTRACTIONS IN ISOLATED STRIPS OF MOUSE UTERINE TISSUE^{BBB}
- 9:00 158. THE PHYSIOLOGICAL EFFECTS OF *CRESCENTIA CUJETE* (CALABASH TREE) FRUIT ON UTERINE MUSCLE CONTRACTIONS OF *MUS MUSCULUS* IN VITRO^{BBB}
- 9:20 159. MYOSIN HEAVY CHAIN GENE EXPRESSION DUE TO AN INCREASED CREATINE-MONOHYDRATE LEVEL AMONGST EXERCISED AND NON-EXERCISED MICE (*MUS MUSCULUS*)
- 9:40 160. EFFECTS OF BODY POSITION AND ARM ON BLOOD PRESSURE RECORDINGS IN FEMALES^{BBB}
- 10:00 161. TARGETING GENE DELIVERY BY LENTIVIRAL DISPLAY OF STEM CELL FACTOR
- 10:20 Section Business Meeting: Election of New officers & new Business
- 11:00 General Session III—Will Climate Change Decrease Agriculture's Ability to Feed the World? , Kent Campus Center, Hubbell South
- 1:15 162. DISCOVERY OF CANDIDATE GENES CAUSING GLAUCOMA THROUGH STUDIES OF PROTEIN-PROTEIN INTERACTION THROUGH THE YEAST TWO-HYBRID ASSAY
- 1:35 163. A COMPARISON OF THE EFFECT OF TRADITIONAL CARDIOVASCULAR EXERCISE AND VIDEO GAME EXERCISE ON $\text{VO}_{2\text{MAX}}$, RESTING RER, RESTING HEART RATE, AND MUSCLE STRENGTH
- 1:55 164. ISOKINETIC ASSESSMENT OF PEAK TORQUE VALUES AND ISOTONIC CONTRACTIONS IN DIVISION I SOFTBALL ATHLETES

NOTES AND DOODLES



ABSTRACTS BY SECTION

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 by Tri-Beta members are labeled with a ^{BBB} symbol at the end of the abstract title. 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.

A nthropology Section Poster Presentations

1. POWER OF THE PEOPLE: A SAMPLE OF ENVIRONMENTAL ETHOS IN NORTH SUMATRA AND JAKARTA

Nicole Laurito and Rebecca Christoffel
Iowa State University

Since 1990, 7.5 million hectares of Sumatran rainforest have disappeared. With this dramatically altered landscape, cultures that had once created rich and complex civilizations around rainforests are now living in western-style housing with limited access to their environmental heritage. I wanted to investigate how that sudden change would affect rural Sumatrans' attitudes towards the environment and conservation efforts and how these attitudes compared to urban people. In summer 2012, I traveled to Sumatra and conducted 20 interviews with rural and urban adults regarding the environment and conservation. There were stark, but expected, differences of opinions between the two groups, but also surprising similarities. Overall, both groups demonstrated concern for the environment but rural interviewees were much more knowledgeable and active on the issue. A vast amount remains to be learned about how the practical demands of survival complicate intentions to care for the earth in the future.

A nthropology Section Oral Presentations

2. ARCHAEOLOGICAL INVESTIGATIONS AT ERB TANKS ROCKSHELTER, A MIDDLE AND LATER STONE AGE SITE IN THE CENTRAL NAMIB DESERT OF NAMIBIA

Theodore Marks and James Enloe
University of Iowa

The Middle to Later Stone Age transition in Southern Africa is one of the great unresolved mysteries in archaeology. Sometime in the Late Pleistocene, humans in Africa began producing archaeological assemblages broadly similar to the material culture of recent known hunter-gatherer groups. Over a span of several tens of thousands of years and in a discontinuous fashion, these new types of toolkits came to dominate the archaeological record of Southern Africa. However, the reasons for this dramatic shift remain poorly understood. Part of the problem stems from our relatively small sample of archaeological sites in Southern Africa and our incomplete understanding of the ways people used technology to adapt to diverse environments. Here we report on the ongoing work being undertaken by University of Iowa researchers at Erb Tanks Rockshelter in the Central Namib Desert of Namibia. With evidence of occupations extending possibly as far back as 130,000 years ago, Erb Tanks is the only known archaeological site from the Central Namib to preserve traces of both Middle and Later Stone Age human activity. As such, research at Erb Tanks offers a unique opportunity to understand how humans adapted to the harsh desert climate of the Namib with two different technological strategies. Moreover, this research highlights some of the important contributions Iowa scientists are making in global debates in paleoanthropology.

3. IOWA'S BATS AND THE TENNIS RACQUET: HOW ETHNOGRAPHY OF PUBLIC OPINION CAN ASSIST BIOLOGISTS, ECOLOGISTS, FIELD RESEARCHERS, AND OTHER SCIENTISTS

Kristie Burns and Ron DeArmond
Pella Wildlife Company

By applying the scientific method of ethnography to the topic of public opinion of bats in Iowa I was able to work with the staff

biologists, ecologists, educators, and the CEO of Pella Wildlife Company to develop more effective and efficient methods of field research and public science education. The science of ethnography allows the anthropologist to gain unique and valuable insight into cultural points of view using methodical, measurable, and organized techniques. By using participant observation, triangulating data from different sources, gathering qualitative data from interviews and documents, and using interpretive mapping and linguistic analysis, the ethnographer is able to create a working model of a cultural viewpoint that provides essential guidance to biologists, ecologists, field researchers, teachers, and other scientists. As the ethnographer at Pella Wildlife Company, I used scientific database methods that include open coding, axial coding, selective coding, and comparative analysis of data. This data was then used to develop theories, which were then cross-referenced with interviews and research. This data was also gathered into patterns, categories, and key themes, which allowed me to then create meaningful culturally based questionnaires and gather additional data. In anthropology statistic data-gathering questionnaires are given after the ethnography is done. It is believed that only after one has carefully observed the subjects can they really ask valid questions to the group. From this process a final model emerged that was in the form of a textual description and a causal diagram. My colleagues then used this textual description and causal diagram to make decisions about field study locations and subjects, record collection methods, presentation of data to the public, educational methods and approaches, investigative focus, and project time frames.

Cellular, Molecular & Microbiology Section Poster Presentations

4. IDENTIFICATION OF HUMAN HOST PROTEINS THAT INTERACT WITH SWINE INFLUENZA A VIRUS NUCLEOPROTEIN USING THE YEAST TWO-HYBRID SYSTEM^{BBB & ISGC}

Jeff Barcus, Alex Generous, Joe Jacher, Molly Thorson, Marc Busch, and Heidi Slesiter
Drake University

Influenza causes 250,000 to 500,000 deaths per year worldwide. The influenza A virus (IAV) is an enveloped, negative single-stranded RNA virus whose genome encodes up to 12 proteins. The IAV nucleoprotein (NP) is a structural protein that associates with the viral RNA and is integral for virus replication. Knowing how the IAV interacts with the host's proteins is essential for understanding the mechanism for viral replication and restrictions in species host range, as well as for developing effective antiviral treatments. Yeast two-hybrid (Y2H) technology al-

lows for identification of protein interactions. In this study, a NP from a swine IAV was cloned into a Y2H bait vector for expression of a yeast Gal4 binding domain (BD)-NP fusion protein. This bait was used to screen a Y2H human HeLa cell prey library which consisted of human proteins fused to the Gal4 protein's activation domain (AD). The interaction of bait and prey proteins resulted in activation of reporter genes. Using this approach, 40 positive bait-prey interactions were initially detected, 17 of which were confirmed as positive interactions in yeast. Isolation and sequence analysis of the cDNAs encoding the human prey proteins revealed 10 different human proteins. These proteins play roles in purine biosynthesis, DNA-binding, microtubule polymerization, potassium channel formation, zinc transporter function, Na⁺/K⁺ ATPase function, RNA splicing, and hepatic metabolism. These proteins are currently being assayed in yeast for interactions with a NP from a human IAV. In the future, the protein interactions identified in yeast will be verified in mammalian cells by co-localization and co-immunoprecipitation experiments.

5. TOWARD THE CHARACTERIZATION OF ESSENTIAL HERPESVIRUS INTERACTIONS

Molly M. First, Hanna H. Stenzel, Richard J. Roller, and Joseph G. Nguyen
Mount Mercy University

Antiviral drugs are a class of medication used specifically for treating viral infections. Unfortunately, the range and scope of antivirals are limited. Antiviral drugs are different than antibiotics because they do not destroy their target pathogen; instead they inhibit their development. Thus, it is important to study the interactions of certain viral proteins so we can better understand how to inhibit the development effectively. Nuclear egress is a very attractive target for potential antiviral drugs because it is a conserved process in all herpesviruses and utilizes viral proteins that do not resemble any cellular proteins. There are two viral-specific proteins, UL31 and UL34, essential for nuclear egress in Herpes Simplex 1 virus (HSV-1). Two separate interactions, which involve specific conserved regions (CR), between the two HSV-1 proteins cause colocalization of the viral capsid to the inner nuclear membrane. In order to better understand these interactions, it is important to obtain the conserved regions in isolation so the characterizations can be better characterized. It is hypothesized that the isolated CR1 of UL31 will interact with isolated CR3 of UL34 and that isolated UL34 CR1-2 will interact with isolated UL31 CR3-4. The presentation will discuss the efforts made towards cloning and expressing the isolated regions and the interaction studies.

6. SCREENING FOR *LISTERIA* MUTANTS WHICH LYSE WITHIN THE HOST CYTOPLASM^{BBB}

Kevin Hughes¹, Dan Pensinger², and John-Demian Sauer²
Simpson College¹, University of Wisconsin²

Many hosts have developed strategies for detecting and eliminating invading pathogens. These strategies include both methods involved in innate and adaptive immunity such as programmed cell death and production of antibodies, respectively. To disarm and evade these strategies, intracellular pathogens have developed their own strategies for successful invasion and infection of a host. This includes activating and deactivating genes to allow for growth of a pathogen in nutrient-limited cytosol of host cells. We performed a genetic screen to find *Listeria monocytogenes* mutants that are unable to grow successfully in the cytosol of macrophages. We wanted to determine the adaptations that allow for *L. monocytogenes* to survive and grow in a host cell and what defense host cells use for recognition and destruction of intracellular pathogens. We screened 1,000 mutants and found 57, which have defects that inhibit growth in the macrophage cytosol.

7. MOLECULAR ANALYSIS OF INCOMPATIBILITY GROUPS FROM CONJUGALLY-TRANSFERRABLE SALMONELLA PLASMIDS

Holly J. Hulsebus, Allen J. Kempf, and Samina Akbar
Des Moines University

Salmonellosis is a significant cause of morbidity and mortality worldwide. Some *Salmonella* species carry multiple antimicrobial resistance genes both in the chromosome and on mobile genetic elements. *Salmonella* species carrying antibiotic resistance plasmids can potentially disperse new resistance genes, such as *cmy2*, to other *Salmonella* species and enteric bacteria commonly found in the human and animal gut. These plasmids are often categorized into incompatibility groups based on their mechanism of replication and maintenance within the bacterial cell. We hypothesize that plasmid-bearing *Salmonella* have variable efficiency and capacity to transfer plasmids from different incompatibility groups and that certain incompatibility groups may be responsible for the transfer of integrons to a recipient strain. To test our hypothesis, we obtained human and animal isolates of plasmid-bearing *Salmonella enterica* and attempted to conjugate each with an *E. coli* recipient strain. We used TSI slants as well as plasmid DNA purification from the test colonies to confirm that our recipient strains had received the plasmid(s) and were true transconjugants. We then performed multiplex PCR to determine which plasmid incompatibility groups were conjugally transferred. Our experiments thus far show that (a) Our 16 *Salmonella enterica* isolates carry a broad range of incompatibility groups; (b) 4 out of 15 CMY2 plasmid-bearing *Salmonella* isolates and 1 isolate containing a large non-CMY2 plasmid were able to conjugally transfer one or more plasmids to an *E. coli* recipient strain; (c) The A/C and I1 incompatibility groups are the most consistently transferred; and (d) A Class 1 integron was transferred to 1 out of 5 transconjugants, and a Class 2 integron was transferred into one separate transconjugant. These experiments will enhance our understanding of the mechanisms and conditions required for the natural spread of multiple drug resistance among enteric bacteria.

8. INSERTIONAL MUTAGENESIS OF A HEPATOTOXIN SYNTHASE GENE IN *MICROCYSTIS AERUGINOSA*

Aaron Lacy, Breanna Fecht, and Ryan Bezy
Mount Mercy University

The freshwater cyanobacterium *Microcystis aeruginosa* produces a heptapeptide hepatotoxin called microcystin. Animals drinking from contaminated water supplies are exposed to microcystin, which can then enter the bloodstream, be taken up by liver cells, and inhibit serine/threonine phosphatases. This can lead to excessive phosphorylation of structural filaments, cytoskeleton degradation, and breakdown of the hepatic cell ultra-structure, leading to liver cancer with prolonged exposure. While the genes encoding microcystin synthesis enzymes are well understood, the ecological significance of microcystin to *M. aeruginosa* is not. It is hypothesized that the production of microcystin results in a competitive advantage against eukaryotic, mainly algal, species in its environment. To test this hypothesis a non-toxin producing strain of *M. aeruginosa* will be created by deletion of the *mcyB* gene, which is part of the *mcy* gene cluster. *McyB* gene sequences, with the internal portion of coding sequences deleted, will be cloned into the pRL278 plasmid construct. This construct will then be transformed into *M. aeruginosa* and used in homologous gene replacement to create a strain of *M. aeruginosa* incapable of toxin production. Once created, the toxin-less strain of *M. aeruginosa* will be used in competition studies against algal species and compared against the toxin-producing strain of *M. aeruginosa*.

9. PROTEIN PURIFICATION OF RNS1 FOR FUNCTIONAL CHARACTERIZATION^{BBB}

Siew Szen Ling
Iowa State University

Plants respond to injury by inducing various defense-related genes. During mechanical wounding in *Arabidopsis thaliana*, RNS1 (an RNase T2 enzyme transcript) and protein are induced both locally and systemically. RNS1 is speculated to have antimicrobial properties, therefore involved in plant defense mechanism. To understand the biological function of RNS1, pure RNS1 protein has to be purified for functional characterization. Thus, the yeast protein expression system was used for secretion and intracellular expression of the RNS1 protein. The yeast expression plasmid YEpWL was transformed by selection on -trp plates. Growing the yeast strain in low phosphate medium then induces the secretion of RNS1 protein. The protein obtained was dialyzed and purified on an anion-exchange column using fast protein liquid chromatography (FPLC). The purification of RNS1 protein with FPLC gave a single absorbance peak corresponding to RNS1 protein at approximately 0.2 M NaCl showing that the target protein is present. Subsequent activity gels along with Coomassie blue and silver staining of protein gels confirmed that RNS1 is the only active protein that was obtained from our protein purification. After sufficient RNS1 protein is obtained, various experiments testing for the antimicrobial prop-

erties of RNS1 protein can be carried out.

10. SQUASH THAT INHIBITION: POLYPLOIDY IN PRAIRIE PLANTS

Alex Renee Paine, Tesia Sue Posekany, Robert Glen Kestel, Kayla Lynne Strain, and James Hampton
Buena Vista University

The prairie plants of Iowa are of particular interest due to the number of interesting physical and biochemical adaptations to the environment around them. They were used medicinally by Native Americans and some were included in the U.S. Pharmacopeia. Our research group has pioneered efforts to introduce *Ratibida pinnata* (grey-headed coneflower), *Asclepias tuberosa* (butterfly milkweed) and *Monarda fistulosa* (bergamot) into tissue culture. We have also treated these tissues with different mutagens, such as the microtubule inhibitor colchicine; colchicine has been known to generate a tetraploid genotype. The callus was exposed to different concentrations of colchicine combined with different exposure times to observe the effects of the microtubule inhibitor on the ploidy level of the cells, as well as any other genetic mutations. Preliminary results indicate that colchicine causes an increase in cell size near twice that of the original, untreated cells. Our efforts concentrated on re-differentiating our treated plant cells and performing a root tip squash as a means of determining chromosome number.

11. CAN RETARGETED ONCOLYTIC MEASLES VIRUS BYPASS NEUTRALIZING MONOCLONAL ANTIBODIES?

Roland Pappoe¹, Patrycja Lech², and Stephen J. Russell²
Buena Vista University¹, Mayo Clinic²

Most viruses over the years have been tested for oncolytic effectiveness, and the measles virus (MV) emerged as a promising cancer therapeutic. One major hurdle facing the development of MV as an oncolytic is antibodies in the blood which tend to neutralize the virus. In this experiment, we determine if a C-terminal domain engineered onto the measles virus H glycoprotein (used to retarget the virus to cell types of choice) protects the virus from neutralizing antibodies. MV is retargeted by engineering a domain which serves as a ligand at the C-terminus of the H protein without affecting the fusion activity. Here a variety of ligands were successfully displayed on the H protein. These include single-chain antibodies against EGFR, EGFRvIII, Wue1, and echistatin. These viruses are currently under study.

12. MOLECULAR DYNAMICS SIMULATIONS OF THE THERMOSOME, A GROUP II CHAPERONIN: ROLE OF WATER IN PROTEIN FOLDING

William Pfau and Andy Thomas
Morningside College

Proper protein folding is essential for life. Misfolded proteins are

the cause of many neurodegenerative diseases in humans, such as Alzheimer's and Parkinson's disease. Our body's way of combating these misfolded proteins comes in the form of chaperones and in particular chaperonins. Chaperonins are proteins whose specific function is to provide an environment favorable for proper protein folding. For this to occur the unfolded protein must enter the folding cavity of the chaperonin and folding ensues. An exact explanation of how proteins fold inside this cavity has yet to be determined. Of particular interest are the group II chaperonins (often called the thermosome) or CCT in humans. For this project, we performed a series of molecular dynamic simulations of the thermosome from *Methanococcus maripaludis*. We simulated the thermosome in a variety of conditions: (a) in a solution of 150 mM KCL to mimic in vivo conditions, (b) the thermosome with an unfolded protein inside the folding cavity, and (c) a pure water sample. These simulations allowed us to examine water dynamics using the Einstein relation to compute diffusion coefficients. Additionally, we examined how confinement of water molecules in the thermosome affects hydrogen bonding. The observed results suggest a possible role for water molecules in the proper folding conditions of the cavities of group II chaperonins.

13. HUMAN CYTOMEGALOVIRUS RESISTANCE TO DEOXYRIBOSYLINDOLE NUCLEOSIDES MAPS TO A POINT MUTATION IN THE TERMINASE SUBUNIT ENCODED GENE UL89

Quang Phan¹, Ellie D. Hall², Julie M. Breitenbach³, Katherine K. Borysko³, Leroy B. Townsend³, Jeremy P. Kamil², John C. Drach³, and Brian G. Gentry¹
Drake University¹, Louisiana State University², University of Michigan³

Human cytomegalovirus (HCMV) infection can result in severe disease including retinitis and encephalopathy in immunocompromised patients and mental retardation, vision, and/or hearing loss in immunologically immature patients. Current chemotherapies for managing HCMV infections include ganciclovir (GCV), cidofovir, and foscarnet, but these can result in serious adverse effects including myelosuppression or nephrotoxicity. The deoxyribosylindole nucleosides constitute a new class of compounds that demonstrate 20-fold greater activity ($IC_{50} = 0.34 \mu M$) compared to GCV ($IC_{50} = 7.4 \mu M$) without any observed increase in cytotoxicity. Previous studies have demonstrated that HCMV resistant to the chemically related benzimidazole ribonucleosides is also resistant to indole nucleosides. The benzimidazoles act late in the viral replication cycle by inhibiting the viral terminase but are not viable clinical candidates due to poor pharmacokinetic profiles in vivo. The HCMV terminase, encoded by genes *UL56* and *UL89*, is an enzyme that cleaves high-molecular-weight DNA concatemers into genome length units and is necessary for viral genome processing and packaging. We, therefore, hypothesize that the indole nucleosides target the HCMV terminase. To test this hypothesis, an indole-resistant HCMV was isolated, its genome sequenced, and a G766C base pair mutation in the exon 1 of *UL89* was identified. This mutation resulted in an

E256Q amino acid change, which is unique and distinct from the mutations previously discovered that confer benzimidazole resistance (D344E and A355T). We surmise that this mutation is responsible for HCMV resistance to the indole nucleosides and further studies are ongoing to confirm this hypothesis.

14. SUBCELLULAR LOCALIZATION OF CONSTRUCTED TUMV NIA-PROTEASE MUTANTS

Tesia Posekany¹, Chunling Yang², and Steve Whitham²
Buena Vista University¹, Iowa State University²

Turnip mosaic virus (TuMV) is a detrimental virus of most cruciferous plants. TuMV and other plant viruses elicit host defense mechanisms and can alter host plant metabolism. Some of the changes these viruses cause in the host plant may benefit the insect vectors that the viruses rely on for transmission. TuMV and its primary insect vector, *Myzus persicae* (green peach aphid), interact with model plant species *Arabidopsis thaliana* and *Nicotiana benthamiana* in a way that allows research into the molecular mechanisms that affect the plant-virus-vector relationship. TuMV encodes 11 proteins, all of which have been tested for their effects on aphid growth. This project focused on the subcellular localization of TuMV nuclear inclusion protein-a (NIA-protease). Green fluorescent protein (GFP)-tagged plasmids containing NIA-protease will be constructed to include nuclear inclusion or export signals. These plasmids will be expressed in *A. thaliana* and *N. benthamiana*. Location of NIA-protease will be observed using fluorescence microscopy. Colleagues at Cornell University will later observe *M. persicae* interactions with *A. thaliana* and *N. benthamiana* that express novel NIA-protease mutants in an effort to understand the importance of subcellular localization of NIA-protease in the plant-vector-virus relationship.

15. DECREASES IN HERPES SIMPLEX VIRUS 1 AND 2 REPLICATION BY THE TELOMERASE INHIBITOR MST-312

Scott Roberts, Prajakta Pradhan, and Marie L. Nguyen
Des Moines University

Herpes simplex viruses (HSVs) are the causative agents of cold sores and genital herpes. Once HSV has been contracted, it remains in a latent phase and cannot be eradicated. A possible therapeutic strategy is to target cellular host factors needed by the virus to complete its life cycle. One such potential target is telomerase. Telomerase is the enzyme responsible for replicating the telomeres, which are non-coding regions at the end of chromosomes that prevent loss of DNA after every round of replication. Previous results in our laboratory have shown that a telomerase inhibitor, MST-312, had a negative effect on the replication of the KOS1.1 strain of HSV-1. To determine if telomerase plays a role in the life cycle of other HSV strains, HEp-2 cells were infected with several laboratory derived strains or a recent clinical isolate of HSV-1 and an HSV-2 strain in the presence or absence of MST-312. In all viral strains tested we saw a reduction of viral replication from samples that were treated with the te-

lomerase inhibitor as measured by plaque assay. We also found a reduction in the accumulation of the late viral protein VP22. These results led us to conclude that MST-312 has a negative impact on the HSV-1 and HSV-2 life cycles. We further determined that MST-312 led to reduced VP22 protein accumulation and viral replication in cells that use an alternative, telomerase independent mechanism for lengthening telomeres (U2OS). This suggests that MST-312 may be acting on HSV through a telomerase-independent mechanism.

17. DEFECTS OF SIR2 AND SIR3 DEACETYLASES INCREASE YEAST RESISTANCE TO BORIC ACID^{ISF}

Andrew D. Sims, Michael P. Boyer, and Martin Schmidt
Des Moines University

A genome-wide mutant screen revealed that a loss of protein deacetylase activity renders cells hyper-resistant to boric acid (BA). Our data show that both *sir2* and *sir3* mutants show increased resistance to BA. Both *sir2* and *sir3* genes code for components of the histone deacetylase complex that is responsible for transcriptional silencing. Sir2 belongs to a conserved family of protein deacetylases (sirtuins) that have been shown to be involved in regulating the lifespan of eukaryotic organisms. Since sirtuin activity depends on the concentration of the metabolic electron acceptor NAD, the enzymes provide a link between metabolic activity, gene silencing, and proliferation. A loss of SIR2 function has been shown to abolish chromatin silencing at certain loci and to decrease the lifespan of a variety of organisms, including yeast. It has been postulated that *sir2* activity extends the life of cells by signaling low metabolic activity during caloric restriction. In order to characterize the effect of *sir2* on BA-treated yeast, we examined the expression of the stress response protein Tps1 in BA-treated cultures of *sir2* mutants by flow cytometry. We observed no significant differences of the expression of the Tps1-GFP reporter during BA stress between wildtype and *sir2* mutants. We conclude that a *sir2* mutation improves yeast resistance to BA stress through a mechanism that is independent of Tps1p-induction. Considering the data showing that BA increases metabolic activity in yeast, we hypothesize that a *sir2* mutation improves BA survival by disabling the signal for high metabolic activity that would otherwise shorten the yeast lifespan.

18. PHENOTYPIC ANALYSIS OF RIBONUCLEASE AND AUTOPHAGY MUTANTS RELATED TO RIBOSOME TURNOVER

Melanie Torrie, Brice Floyd, Stephanie Morriss, Gustavo MacIntosh, and Diane Bassham
Iowa State University

Nifedipine (NIFE) loaded monoglycerides-matrices were formulated and investigated for protection against photo-induced degradation. The extent of degradation of NIFE in a monolaurin (ML) matrix was measured by exposing the drug-matrix mixture to light, increasing temperature, and varying lengths of exposure. A stability indicating high-performance liquid chromatography (HPLC) method for identification and quantification of NIFE was developed. The mobile phase was methanol:water (70:30, v/v) eluded at 1.0 mL/min. The method was linear in the concentration range of 0.1-10 µg/mL ($r^2 = 0.9996$). Different ratios of NIFE-to-ML matrices were formulated and studied. Formulation of NIFE:ML (1:9) matrix was found to be uniform with percent NIFE composition 103 ± 5 . Exposure of the NIFE-loaded ML matrix in solution was shown to have 60% degradation within 6 hours: Whereas, NIFE in solution showed over 95% degradation. The morphology of NIFE-loaded ML matrix was characterized by Differential Scanning Calorimetry (DSC). The absence of an endothermic melting peak at 173 °C indicates that NIFE is in an amorphous state. These results indicate that monoglycerides can be used in formulation to help increase the stability of NIFE.

Cellular, Molecular & Microbiology Section Oral Presentations

19. THE ANTIBACTERIAL EFFECT OF THE GOGGLE SANITIZER^{BBB}

Bridget A. Richardson and Jeanne M. Minnerath
Saint Mary's University of Minnesota

Ultraviolet light is often used as a means of disinfection due to its antibacterial properties. It is commonly used to disinfect surfaces and inanimate objects. Some, however, question whether ultraviolet radiation is a practical means of disinfection particularly due to the health risks associated with exposure. At Saint Mary's University of Minnesota, the Goggle Sanitizer made by Flinn Scientific, Inc. is used to disinfect plastic goggles shared by students in chemistry laboratory courses. This means of disinfection uses ultraviolet light to eliminate microorganisms present on the goggles. The purpose of the present study was to determine whether the Goggle Sanitizer was effective at disinfecting plastic eye wear used in the chemistry department at Saint Mary's University of Minnesota. To complete this study, sterile cotton swabs were used to obtain bacteria from the nose-piece of a pair of plastic goggles before and after disinfection in the Goggle Sanitizer. The cotton swabs were placed into test tubes containing tryptic soy broth. The test tubes were then shaken to dislodge any bacteria present on the cotton swabs. Next, aliquots of the bacterial solutions were spread onto petri dishes containing tryptic soy agar. The plates were incubated for 24 hours at 37 °C.

The number of bacteria present on the goggles before and after the use of the Goggle Sanitizer was determined. Statistical analysis was then completed on the data to determine whether the Goggle Sanitizer was effective at eliminating bacteria on the eye wear.

20. THE EFFECTS OF ETS-RELATED TRANSCRIPTION FACTOR 81 OVEREXPRESSION ON LUNG DEVELOPMENT IN *XENOPUS LAEVIS* FROGS^{BBB}

Matthew Robey and Brian Hyatt
Bethel University

Mammalian lung development begins as a ventral outpouching in the foregut endoderm. Reiterative branching and segmentation leads to the formation of bronchi and the alveolar gas exchange system. Mammalian development of the lung involves the coordinated interaction of multiple genes, including *Nkx2.1*, *Spc*, *Spb*, *Wnt7b*, *Wnt5a*, *Shh*, and *Wif1*. These genes have also been found in *Xenopus laevis*: demonstrating the potential of *X. laevis* as a model organism for lung development. Disrupted expression of *Ets*-family transcription factors in mice results in disrupted lung development. The *Ets-related 81* (*Xer81*) transcription factor is highly expressed in the mammalian and *X. laevis* lung, but its role in lung development has not been determined. Overexpression of *Xer81* by microinjection is used to determine its effect on the expression of the lung-specific gene *Spc*, thereby indicating the involvement of *Xer81* in lung development.

21. THE EFFECT OF OVER-EXPRESSION OF TBX2 ON EPIREGULIN EXPRESSION IN MCF-10A CELLS^{BBB}

Bridget Trio and Matt Rowley
Saint Mary's University of Minnesota

Breast cancer is the number one cancer related disease of women in the United States. Of those diagnosed 40% of breast cancer patients overexpress the TBX2 transcription factor, which in turn regulates the expression of numerous downstream genes. Unpublished data suggests that TBX2 may up regulate epiregulin expression and subsequently epiregulin signal transduction including the activation of ERK1/ERK2, leading to mammary tumorigenesis. In this study a system was established to overexpress TBX2 in the MCF-10A human mammary epithelial cell line using a lentivirus. Currently, work is focused on the verification of the effect of TBX2 on epiregulin expression and subsequent increase in ERK1/ERK2 activation.

22. MUTAGENIC EFFECT OF PROSCAR (FINASTERIDE) ON HUMAN CULTURED PERIPHERAL BLOOD LYMPHOCYTES USING SISTER CHROMATID EXCHANGE^{BBB}

Joshua Wolfe and Gregg Johnson
Bethel University

Proscar (finasteride) is used to treat benign prostatic hypertrophy (BPH) by inhibiting the enzyme 5 α -reductase, an enzyme necessary to convert testosterone into 5 α -dihydrotestosterone (DHT). DHT is a major contributor to BPH. Finasteride is a drug that has been listed as a hazardous unclassified drug by the Center for Disease Control (CDC). There have been conflicting reports on the mutagenic potential of finasteride. We tested finasteride at clinical doses (2.5 mg/day, 5 mg/day, and 10mg/day) on human peripheral blood lymphocytes using the Sister Chromatid Exchange (SCE) Technique to help clarify the potential mutagenic activity of the drug on human cells. Our early results show an increase in SCEs in treatment cultures compared to controls, which suggests finasteride has a mutagenic effect on human PB lymphocytes.

23. USING FLUORESCENCE MICROSCOPY TO EXAMINE IODIDE UPTAKE BY THE HUMAN SODIUM IODIDE SYMPORTER

Michael Keane¹, Patrycja Lech², Stephen J. Russell², and Brian A. Lenzmeier¹
Buena Vista University¹, Mayo Clinic²

The human sodium iodide symporter (hNIS) is a protein that is expressed in the plasma membrane of cells of the thyroid gland. This protein is able to concentrate iodide inside cells by coupling the unfavorable movement of iodide against its concentration gradient with the favorable movement of sodium down its concentration gradient. To study the activity of hNIS in living cells, we used replication-defective lentiviral vectors to transduce HeLa cells with the hNIS gene and a gene encoding an allele of the yellow fluorescent protein (YFP H148Q I152L) whose fluorescence is quenched in the presence of iodide. Clones stably expressing both proteins were isolated and the activity of hNIS was characterized by measuring the relative decrease in YFP H148Q I152L fluorescence when NaI was added to the medium. Cells were imaged using a confocal microscope and fluorescence before and after NaI addition was quantitated using ImageJ. Cells were then cultured in the presence of a variety of cell-signaling pathway inducers and inhibitors. The influences of these signal transduction pathways on hNIS activity will be presented.

24. USE OF RED FLUOROPHORES TO STUDY CELL MIGRATION AND PROGRAMMED CELL DEATH IN LIVING DROSOPHILA EMBRYOS

Danielle Pohl
Iowa State University

Cell migration and programmed cell death are central features of animal development that help to shape the developing embryo by positioning cells within the embryo and eliminating excess or unnecessary cells. The use of red fluorescent proteins in *Drosophila melanogaster* to allow live image views of migrating cells in the embryo will enable a detailed investigation of the mechanisms by which cells move and die within the early embryo. Currently, vital projects are not possible due to an inability to see many

aspects of cell migration. In this project, the fluorescent proteins are being expressed specifically along with a localizing protein to highlight the developing germ cells. Fluorescent viewing of the migrating germ cells in the embryo is then possible. Because the mechanisms of cell migration and programmed cell death are conserved, data collected from live imaging techniques is applicable to developmental patterns seen in a variety of animals.

25. ANTIBIOTICS INFLUENCE THE DISTRIBUTION OF MITOCHONDRIA IN HUMAN CELLS

Jacklyn Marie Johnson and Brian Lenzmeier
Buena Vista University

Although antibiotics have proven to be instrumental within the healthcare field, they still produce mild to severe side-effects within the human population. Some of these side-effects could be caused by the antibiotics' effect on cellular components. Of particular interest are antibiotics, like chloramphenicol and tetracycline that inhibit bacterial ribosomal activity. Due to the evolutionary origins of mitochondria explained by the endosymbiotic theory, antibiotics that inhibit bacterial ribosomal activity may also target mitochondrial ribosomal activity. Therefore, my research examined the effect of antibiotics on the location and function of mitochondria in human cells. Human cancer cells (HeLa) were obtained and treated for a designated time with one of the following antibiotics: chloramphenicol, tetracycline, or ampicillin. After treatment, cells were stained with MitoTracker deep red (mitochondrial stain) and WGA Alexa Fluor 488 (cell surface stain) before being imaged using confocal microscopy. Mitochondrial location within cells was observed relative to the cell surface. The resulting images showed mitochondrial clustering towards the nucleus when cells were treated with chloramphenicol. Cells left untreated or treated with ampicillin and tetracycline had mitochondria dispersed throughout the cell.

26. SUSCEPTIBILITY OF *PROPIONIBACTERIUM ACNES* TO ANTIBIOTICS AND PA6 PHAGE

Byron Brown, Kayla Schaefer, and Rachel Robson
Morningside College

Propionibacterium acnes are strongly correlated with acne in young adults. *P. acnes* infections are often treated with minocycline, clindamycin, doxycycline, erythromycin, and tetracycline, but long-term antibiotic treatment is feared to lead to resistance in these organisms. *P. acnes* isolates were collected from volunteers (N = 21) using Nu-pore Nose Cleansing Strips applied to the bridge of the nose and were plated on blood agar, incubated anaerobically for seven days. The samples were identified as *P. acnes* if they fluoresced orange under a Wood's lamp and confirmed to be *P. acnes* using standard PCR techniques using primers specific to *P. acnes*. Kirby-Bauer tests were done to test antibiotic susceptibility to minocycline, clindamycin, doxycycline, erythromycin, and tetracycline. The susceptibility of *P. acnes* isolates to phage PA6 was also assessed. Phage treatment of acne may be an alternative to long-term antibiotic treatment in the future.

27. EFFECTIVENESS OF TWO PHAGES AGAINST COMMUNITY-ACQUIRED METHICILLIN-SUSCEPTIBLE AND METHICILLIN-RESISTANT *STAPHYLOCOCCUS AUREUS* ISOLATES

Rachel Robson, Tanner Ferguson, Nathaniel Drees, and Quinton Behlers
Morningside College

Phage K and phage Msa are two lytic bacteriophages of *Staphylococcus aureus*. Both phages have been described as being able to kill some methicillin-susceptible (MSSA) and methicillin-resistant (MRSA) strains of *S. aureus*. In this study, community-acquired *S. aureus* isolates (N = 25) were treated with preparations of either phage K or phage Msa (MOI > 200). Two-thirds of isolates tested (n = 17) exhibited some susceptibility to phage K, although susceptibility to phage Msa was not observed in any isolates. Two MRSA strains were susceptible to phage K. Determining the prevalence of phage susceptibility in isolates of opportunistic pathogens like *S. aureus* may lead to improved treatments, as bacteria increasingly develop resistance to antibiotics.

28. DEVELOPING RESOURCES TO IDENTIFY THE EFFECTS OF GRAVITY ON INFLUENZA A VIRUS REPLICATION^{1ISGC}

Alexis Balgeman, Emily Garnett, Eric Hansen, Whoopi Masquai, Elizabeth Sommers, Rosalie Sterner, and Marc Busch
Drake University

Microbes are important factors in determining human health and disease. As our endeavors in space exploration and human existence in space continue, it is critical to understand how the conditions encountered during spaceflight and extended stays in space may alter host-microbe interactions. Thus far several bacterial pathogens have been examined in terms of the effects of microgravity on gene expression, particularly as it relates to virulence factors. In order to understand the effects that low gravity conditions may have on various stages of the influenza A virus life cycle, it is critical to develop appropriate assays, techniques, and reagents. In mammalian cells, expression of the influenza A hemagglutinin (HA), neuraminidase (NA) and matrix 1 (M1) genes from a mammalian expression plasmid, results in the production of virus like particles (VLPs). Currently, using the HA and NA from two separate influenza A viruses, conditions are being optimized for production of VLPs. The use of these particles allows for quantification of how well a virus can bind to target cells in the absence of using infectious virus. In a separate project, a reporter cell line that contains the complementary sequence for the green fluorescent protein (GFP) gene flanked by the influenza A 5' and 3' untranslated regions is being generated. In the presence of the influenza A replication complex (polymerase subunits PA, PB1, PB2 along with the nucleoprotein), the GFP mRNA will be synthesized allowing for translation of the GFP gene. By quantifying the levels of fluorescence, it is possible to examine the effects that gravity has on influenza A genome replication. Finally, to examine the effects of a low gravi-

ty environment, conditions for growth of lung epithelial cells are being optimized. These cells will be utilized to examine potential effects on cell morphology, changes in cellular cytoskeleton, effects on host gene expression, influenza A virus binding (via VLPs), and genome replication (via the aforementioned reporter cell lines). The progress in development of these assays and techniques will be reported.

29. CHARACTERIZING DUAL INFECTION AND SUPERINFECTION INHIBITION BY TWO ALPHAHERPESVIRUSES IN A NATURAL HOST WITH SCANNING CONFOCAL MICROSCOPY AND TRANSMISSION ELECTRON MICROSCOPY

Molly M. First, Hanna H. Stenzel, Keith W. Jarosinski, and Joseph G. Nguyen
Mount Mercy University

Hosts can be infected with multiple herpesviruses, known as superinfection; however, superinfection of cells is rare due to the phenomenon known as superinfection inhibition. While it is believed that dual infection of cells can occur in nature, it has not been directly shown in a natural model. Thus, it is important to find and study a good natural model for dual infection of cells so we can better understand pathogenic principles of human herpesvirus disease. Gallid herpesvirus 2 (GaHV-2), better known as Marek's disease virus (MDV), in chickens is an excellent pathogen-host model because the early and late stages of infection of chickens with MDV largely mimic those of varicella-zoster virus (VZV), which commonly causes chicken pox in children and adults. Recently, fluorescently tagged viruses were developed so they can be tracked in the feather follicle epithelial skin cells for easy identification. However, it is essential to better identify the viruses infecting the feather follicles using transmission electron microscopy. The presentation will discuss the efforts made towards effectively identifying the infectious viruses utilizing both scanning confocal microscopy and transmission electron microscopy.

30. DEGRADATION AND UTILIZATION OF COMPLEX CARBOHYDRATES BY *TRICHOMONAS VAGINALIS*^{1SF}

Ryan D. Huffman, Lauren D. Nawrocki, Tyler J. Nielsen, Wayne A. Wilson, and Andrew Brittingham
Des Moines University

Trichomonas vaginalis is a protozoan parasite that is the causative agent of trichomoniasis, a widespread sexually transmitted disease that affects millions worldwide. Several reports suggest that infection with this protozoan correlates with a decrease in the glycogen content of the vaginal epithelium. Most studies of *T. vaginalis* include the maintenance of parasites in media containing either glucose or maltose as carbohydrate sources. Here, we demonstrate that *T. vaginalis* grows equally well in media containing the glucose polymers amylopectin or glycogen as the principal carbon source. Having demonstrated the ability of *T. vaginalis*

to grow and utilize these polymers to support growth, we sought to analyze cell pellets and culture supernatant for hydrolytic activity towards amylopectin. We hypothesized that *T. vaginalis* utilizes glucose polymers by first degrading the polymers into smaller subunits. Our data indicate that *T. vaginalis* possess both cell-associated and secreted hydrolytic activity towards glucose polymers and that activity accumulates in the medium during growth. Furthermore, carbohydrate limitation triggers an increase in both activities. Our initial analysis of the secreted activity reveals enzymatic properties consistent with those of an alpha-amylase. Collectively, our data provide evidence for a potential role of glucohydrolases in the growth of *T. vaginalis*.

31. AN EXAMINATION OF AN INC A/C PLASMID IN *SALMONELLA TYPHIMURIUM*, AND ITS EFFECTS ON FITNESS AND INVASION


Allen J. Kempf, Holly J. Hulsebus, Jeffrey T. Gray, and Samina Akbar
Des Moines University

Frequent outbreaks of Salmonellosis are a problem of both national and international significance. Some *Salmonella* species carry multiple antimicrobial resistance genes both in the chromosome and on mobile genetic elements, or plasmids. Plasmids can be classified using incompatibility (Inc) typing to determine the type of replication machinery they encode. The Inc A/C replicon type is commonly associated with large plasmids and these large plasmids frequently contain the *blacmy2* gene. These large A/C plasmids typically encode multiple drug resistances, and are capable of containing additional virulence factors. We hypothesize that the possession of an Inc A/C plasmid by isolates will allow for an increase in their fitness when compared to plasmid-lacking isolates. In addition, plasmid-containing isolates exposed to sub-therapeutic concentrations of antimicrobials will exhibit increased fitness when challenged against isolates without antimicrobial exposure. To test our hypotheses, we obtained human and animal isolates of *Salmonella enterica* and screened them using a 3-panel multiplex PCR assay, as well as with simplex PCR for the *blacmy2* gene. Plasmid characterization allowed us to construct isogenic *Salmonella enterica* serovar Typhimurium strains either with or without an Inc A/C plasmid. Plasmid-positive and -negative isolates were separated into two groups. One group was exposed to antimicrobials before beginning growth assays while the other was not exposed to any antimicrobials. These strains were then challenged in multiple growth and fitness assays. We are in the process of examining the invasion properties of these isolates using a J774 macrophage cell line. Our data thus far suggests that (a) 15 of our 16 CMY2 gene-containing strains contain the A/C Inc group, (b) Inc groups FII (43.8%) and I1 (37.5%) are prevalent in the (multiple plasmid bearing) A/C strains examined, and (c) there are no significant differences in growth between our isolates under conditions examined. This study hopes to lead to an increased understanding the role(s) that these plasmids play in both fitness and virulence of *S. Typhimurium* isolates.

32. GENOME-WIDE SCREENING REVEALS CONTRIBUTION OF HISTONE H2A EXCHANGE TO BA SENSITIVITY IN *SACCHAROMYCES CEREVISIAE*

Martin Schmidt, Andrew Sims, and Micheal P. Boyer
Des Moines University

Screening of a yeast mutant library identified four components of two histone exchange complexes as contributors to yeast boric acid (BA) resistance. Mutations in IES2 and ARP8, components of the INO80 complex, lower the resistance to BA. On the other hand, mutations in two components of the SWR1 complex, ARP6 and SWC2 (VPS72), lead to BA hyper-resistance. The SWR1 complex functions in transcriptional regulation by mediating the ATP-dependent exchange of the exotic variants Htz1 of Histone 2A with the standard form H2A. Htz1 is found in the promoter region of stress-inducible genes where it functions in both maintaining the repressed status as well as facilitating transcription by binding the RNA polymerase PolIII. Hypothesizing that a defect in the SWR1 complex facilitates the induction of stress-response genes by increasing the presence of H2AZ transcription activator sites, we proceeded to measure the expression of the broad-range stress indicator protein Tps1p-GFP by flow cytometry. We could show that the SWR1 mutations *arp6* and *swc2* indeed positively affected Tps1-GFP expression. While the wildtype shows a ten-hour delay in Tps1-GFP induction by BA, the induction of this reporter occurs five hours earlier in *arp6* and *swc2* mutants. The function of the INO80 complex is to facilitate histone sliding during chromatin remodeling. Mutations in the INO80 components *ies2* and *arp8* affect the expression of Tps1-GFP during BA stress in a different way. It was found that an *ies2* mutation attenuates the expression of stress genes during BA exposure.



Chemistry Section Poster Presentations

33. MONOGLYCERIDES-BASED THERMO-RESPONSIVE LOCAL DRUG DELIVERY SYSTEMS

Natalie Benson and Abebe Mengesha
Drake University

A major challenge for drug delivery is to initiate and control release of the incorporated drug, from the excipient, only at the target site and at a controllable rate. Particularly in the administration of chemotherapy, improving the spatial and temporal delivery will significantly increase effectiveness and safety of the therapy. In this project, we seek to understand the thermo-mechanical properties of high-purity crystalline monoglyceride blends and design a thermo-responsive drug delivery system that

can be triggered externally to release the chemotherapeutic agents. The goals of this study were to understand the thermo-mechanical properties of the liquid crystalline phases of blends of monoolein (MO) and monolaurin (ML) and design a thermo-responsive drug delivery system that could trigger the release of a lipid-soluble model drug, nifedipine (NIFE). The crystallization behavior of binary blends of MO and ML as characterized by Differential Scanning Calorimetry (DSC) did show temperature-dependent phase transitions. The pure MO exhibited a melting point of 37.6 °C, while the pure ML exhibited a melting point of 63.7 °C. However, in a mixture of the monoglycerides in a ratio of 70:30 MO:ML, the melting point was 42.8 °C. These temperature-dependent phase transitions allowed for the drug release to be studied at 37 °C and 42 °C and analyzed using High Performance Liquid Chromatography (HPLC). The main findings supported the hypothesis that the formulation released more drug at 42 °C than at 37 °C, as there was an increase in drug release of 3.49% after two days between the two temperatures. Based on these results, a binary blend of these monoglycerides show good potential in thermo-responsive local drug delivery of chemotherapy.

34. ARE GENERICS FROM ACROSS THE BORDER SAFE

James I. Estipona, Zachary M. Fritz, Joseph G. Nguyen
Mount Mercy University

Budesonide is a synthetic glucocorticoid used to treat inflammation associated with asthma, Irritable Bowel Syndrome, and Crohn's disease. In the US an oral formulation, Entocort EC, targets inflammation in the ileum and ascending colon. In an effort to find a low cost alternative, many patients are purchasing cheaper alternatives to Entocort EC across the border. One such generic is Budez CR sold by Canadian Online Pharmacies but manufactured in India. Since the generic is sold online, Budez CR is produced and sold without any regulations set by the US FDA or Health Canada, the Canadian equivalent. Without regulations, it is uncertain whether Budez CR is of similar quality as Entocort EC. It was initially important to isolate and analyze the active ingredient, budesonide, in Budez CR using FTIR and NMR spectroscopies. The presentation will discuss how budesonide was found in both Entocort EC and Budez CR. However, further discussions on the extraction procedure will reveal how vastly different the unknown, inactive components of Budez CR are compared to Entocort EC, which could greatly affect the drug's efficacy.

35. PROGRESS TOWARDS THE SYNTHESIS OF TRANS-AVICENNOL

David W. Garwood, Emma L. Baker, and Stephen R. Sieck
Grinnell College

Efforts towards the synthesis of trans-Avicennol are described. This compound has shown high levels of potency as an anti-cancer agent by inhibiting the production of cancer stem-cells. We have previously explored a Pd-catalyzed route towards its formation. However, our current strategy has proven more pro-

ductive and consistent. The aforementioned strategy employs a convergent method starting with phloroglucinol utilizing the Pechmann reaction, pyridine catalyzed condensation, and methylation to construct the tricyclic segment. Friedel-Crafts alkylation will be employed to construct the side chain of the molecule. To date, significant progress has been made with relatively high yields. In addition to the synthesis, characterization of the molecule is underway. Finally, our strategy allows for the derivation of trans-Avicennol.

36. DESIGNING A DNA ORIGAMI SELF-ASSEMBLED STRUCTURE

Joe Grimley, Jesse Smiles, Stephen Henrich, Peter Rietgraf, Arlene Ford, and Ronald Warnet
Simpson College

The specific and powerful binding characteristics of a DNA molecule provide accurate and repeatable translation of the genetic code. These binding characteristics are now being utilized to create complex self-assembled structures with precisely predetermined regioselectivity, a technique known as *DNA Origami*. DNA Origami uses a long, single-stranded DNA genome from a virus to provide a scaffold to which short synthetic oligonucleotides are used as staples to fold the DNA into geometric patterns. CADnano software was used to visualize the design of a novel DNA Origami structure composed of two individual DNA tiles. Each tile has a flat rectangular geometry but different size and shape. Importantly, as each tile is constructed from one viral genome scaffold, both tiles are tethered together by long single-stranded linkers. The tethered design favors intermolecular interactions between the two DNA Origami tiles. Our goal is to develop a specific interaction interface on a DNA origami structure that allows two DNA Origami structures to bind together predictably. Our design gives us a platform to measure the bonding strength between different methods of facilitating binding interactions.

37. DETERMINATION OF HARMALA ALKALOIDS IN THE MINT FAMILY

Catherine Haustein, Elsie Rankin, and Sam Wills
Central College

Harmala alkaloids are carbazole structures that have been researched for their psychological and pharmaceutical importance. It is important to learn more about and discover more sources of harmala alkaloids in order to keep making scientific advances, more specifically, looking within the mint family of plants, which is known to contain different species of harmala alkaloids. In order to determine the presence of harmala alkaloids, analyses of extractions were done using HPLC and fluorescence spectrophotometry. This extraction and analysis of the mint family plants is a further continuation of Natalie Harrington's initial look into Syrian Rue. Mint plants come from the genus *Mentha* and are thought to have similar harmala alkaloids present throughout the genus. Samples were extracted from the plants and run

through reverse phase HPLC with methanol water as mobile phase and C-18 as the stationary phase. The detection was at 340 nm. By comparing the retention times and fluorescence spectrophotometry results of the extractions to the results of the prepared standards, the harmala alkaloids present in each plant were determined. Results indicate that 2-methylharmine and harmalol are the most frequently occurring alkaloids in these mint plants. This genus of plants is showing very consistent results within this analysis.

38. REMOVING CONTAMINANTS FROM OIL USING MAGNETIC ARRAY FILTRATION

Cory Allan Keller¹, Jeff Fleenor², Wanti Muchtar³, and Cathy Haustein¹

Central College¹, Fleenor Manufacturing², Vermeer Corporation³

Magnetic Array Filtration, known as MAF (Patent # 7,662,282B2), was created as an add-on to typical spin-on oil filters by slipping over the casing. The flexible MAF provides 360° coverage of the oil flow with an enhanced magnetic field. The magnets remove additional fine particles from the oil. The magnets in the MAF consist of Nd₂Fe₁₄B, a rare-earth metal composite, and are coated in nickel for protection from corrosion. Knowing the composition of and amount of magnetic particulates captured by MAF in a large filter is important in evaluating if the MAF was able to capture enough to make a substantial difference compared to conventional resin filters. This research examined the composition and size of the particles captured by a MAF from oil in a large Zeigler CAT engine. Atomic Absorption indicated a 95.86% iron composition of the particles. We determined that about 0.25 g of fine magnetic solids were removed by the MAF at in the range of 0.3-30 μm.

39. SYNTHESIS OF PALLADIUM-NACNAC COMPLEXES FOR USE IN HETEROGENEOUS CATALYSIS

Kristopher J. Keuseman and Nicole Morrow
Mount Mercy University

Carbon-carbon bond formation is of great importance in synthetic chemistry. This reaction facilitates the construction of larger, more elaborate molecular structures for use in pharmaceuticals, polymers, agrochemicals, and in applications such as conducting polymers, molecular wires, and liquid crystals. The Suzuki coupling and Sonogashira reactions are two processes used to form new C-C bonds that typically use a homogeneous solution-phase palladium catalyst. Homogeneous catalysts are efficient; however, they are often unrecoverable or recovery requires elaborate processing. Development of a heterogeneous catalyst would be a more green technique, because recovery and reuse may be more feasible. Currently, we are working on creating novel homogeneous catalysts based on palladium-NACNAC complexes. These complexes will then be tested in the Suzuki and/or Sonogashira reactions. Once the catalyst has been proven to be successful for the coupling reactions, we intend to attach these catalyst complexes to solid glass micro-bead supports.

40. SYNTHESIS OF DICHLORODI-P-TOLYLITIN, A PRECURSOR OF SUBSTITUTED W-SN COMPOUNDS

Andrew Mobley and Paulina Panek
Grinnell College

Syntheses of precursor molecules to substituted tin and tungsten compounds, tetra-p-tolylytin and dichlorodi-p-tolylytin, were investigated. Purification methods for small scale synthesis of each of the desired products were established in the initial stage of the research and then evaluated and adjusted to a larger scale (few grams) experiments. Successful (48% yield) large scale synthesis and purification of tetra-p-tolylytin was accomplished. X-ray diffraction, MS, IR, ¹H NMR and ¹¹⁹Sn NMR spectroscopic methods were used to characterize the products. All synthetic attempts at obtaining dichlorodi-p-tolylytin resulted in very low yields (3% yield) and multiple-substituted products. Potential alternative synthetic paths were considered.

41. OPTIMIZATION OF PEPTIC DIGESTION AND HYDROGEN/DEUTERIUM EXCHANGE FOR LIQUID CHROMATOGRAPHY MASS SPECTROMETRIC ANALYSIS OF PROTEINS

Terry R. Schaid Jr. and Elaine M. Marzluff
Grinnell College


This project utilized liquid chromatography (LC) and mass spectrometry (MS) coupled with peptic digestion and hydrogen/deuterium (H/D) exchange for the analysis of multiple proteins. This technique is useful for the characterization of protein dynamics and binding. Peptic digestions and separations were optimized for albumin, hemoglobin, ubiquitin, and lipoprotein lipase (LPL), and both free and immobilized pepsin yielded excellent digestion. A desalting column, which bypassed the LC column, was constructed and incorporated to examine intact proteins. H/D exchange as a function of time will be presented for ubiquitin and albumin samples, showing rates at which the amide hydrogens at the peptide linkage undergo isotopic exchange. These optimization procedures will be used in the future to employ this H/D exchange system coupled with MS to analyze the unfolding of LPL during interaction with its anti-chaperon Angptl4.

42. CHEMICAL STABILITY ENHANCEMENT OF NIFEDIPINE IN MONOGLYCERIDES-MATRICES

Mallory Jasmine Tough and Abebe Mengesha
Drake University

Nifedipine (NIFE) loaded monoglycerides-matrices were formulated and investigated for protection against photo-induced degradation. The extent of degradation of NIFE in a monolaurin (ML) matrix was measured by exposing the drug-matrix mixture to light, increasing temperature, and varying lengths of exposure. A stability indicating high-performance liquid chromatography (HPLC) method for identification and quantification of NIFE

was developed. The mobile phase was methanol:water (70:30, v/v) eluted at 1.0 mL/min. The method was linear in the concentration range of 0.1-10 $\mu\text{g}/\text{mL}$ ($r^2=0.9996$). Different ratios of NIFE-to-ML matrices were formulated and studied. Formulation of NIFE:ML (1:9) matrix was found to be uniform with percent NIFE composition 103 ± 5 . Exposure of the NIFE-loaded ML matrix in solution was shown to have sixty percent degradation within 6 hours; whereas, NIFE in solution showed over ninety-five percent degradation. The morphology of NIFE-loaded ML matrix was characterized by Differential Scanning Calorimetry (DSC). The absence of an endothermic melting peak at 173 $^\circ\text{C}$ indicates that NIFE is in an amorphous state. These results indicate that monoglycerides can be used in formulation to help increase the stability of NIFE.



Chemistry Section Oral Presentations

43. BETTER BUILDING BLOCKS FOR BIGGER DNA ORIGAMI

Courtney Muhlbauer, Andrew Dexter, Maia Kelly, Estefan Herrera, and Derek Lyons
Simpson College

DNA has served biological life for billions of years, providing a means to store and copy the information for a living organism to function. The double-stranded structural features that make DNA biologically functional offer unique advantages to the construction of nanoscale materials. *DNA origami* is a novel nanoscale construction technique that utilizes a single-stranded DNA viral genome as a scaffold that is folded into nanoscale structures by stapling many short synthetic oligonucleotide DNA strands to the scaffold. DNA origami nanostructures have a promising future, advancing fields of research from drug delivery to nanoscale computing. To date, several limitations inhibit the versatility of DNA origami. Primarily, the predetermined length of the viral genome scaffold restricts the size of nanostructures that can be created. Assembling multiple DNA origami structures in a specific arrangement could overcome the strict size limitations. Our recent work documents techniques that block non-specific interactions among DNA origami structures, in addition to designing a novel binding interface that provides predictable and specific interactions between two individual DNA origami structures. This approach has promise to elegantly overcome size limitations by allowing a mixture of DNA origami structures to self-assemble in solution, opening the door to construction of large and complex structures.

44. AROMATIC ORGANOSULFATES IN AMBIENT AEROSOL

Sean Staudt and Elizabeth A. Stone
University of Iowa

Organosulfates account for a significant fraction of aerosol organic matter. However, we do not have adequate knowledge about their molecular level composition, sources, and formation processes. This study confirms presence of aromatic organosulfates in fine particulate matter (PM_{2.5}) samples collected in Lahore, Pakistan; Godavari, Nepal; and Pasadena, California. Authentic standards of phenyl sulfate, benzyl sulfate, 3- and 4-methylphenyl sulfate and 2-, 3-, and 4-methylbenzyl sulfate were synthesized and molecular structures confirmed by qualitative analytical techniques. Authentic standards and aerosol samples were analyzed by ultra-performance liquid chromatography (UPLC) coupled to negative electrospray ionization (-ESI) quadrupole time-of-flight (Q-ToF) mass spectrometry (MS) for the purpose of identifying and quantifying the aromatic organosulfate species of interest. Benzyl sulfate was present in all three samples analyzed, suggesting that it is ubiquitous in the atmosphere. Phenyl sulfate, methylphenyl sulfates, and methylbenzyl sulfates were less abundant and were observed only in samples with strong anthropogenic pollution sources. The aromatic organosulfates observed in this study form a homologous series analogous to anthropogenic volatile organic compounds (VOC) comparative to benzene, toluene, and xylene, and for that reason may serve useful as tracers of anthropogenic secondary organic aerosol (SOA).

45. IDENTIFICATION OF ATMOSPHERIC AEROSOL SOURCES IN IOWA CITY

Chathurika Rathnayake and Elizabeth A. Stone
University of Iowa

Aerosols are liquid or solid particles in a gas, having particle diameters ranging from 1 nm to $\sim 100 \mu\text{m}$. Particulate matter (PM) having aerodynamic diameter less than $2.5 \mu\text{m}$ (PM_{2.5}) is important due to its adverse impacts on human health. Atmospheric aerosols are generated by a wide variety of natural (volcanic eruptions, vegetative detritus, etc.) and anthropogenic (biomass burning, vehicle emissions, etc.) sources. These particles are further classified depending on their origin as primary and secondary: primary aerosols are the direct emissions while secondary aerosols are formed in the atmosphere via gas phase chemical reactions. The concentration, composition, and size distribution of PM are highly variable both temporally and spatially. However, the major components of PM are inorganic ions, sea salt, elemental carbon, and organic matter. Organic molecules can serve as markers to identify and quantify the presence of PM sources. In this study, field sampling was carried out in two different sites in Iowa City with the goal of understanding local pollution sources. Samples were collected on quartz fiber filters from August to November 2011 and organic speciation was accomplished using gas chromatography coupled to mass spectrometry.

etry. The polycyclic aromatic hydrocarbon (PAH) picene was quantified in this experiment as a marker for coal combustion. Hopanes were detected, indicating the presence importance of fossil fuel combustion. n-Alkanes demonstrated an odd-carbon number preference indicative of vegetative detritus in the atmosphere. Ongoing research activities include measurement of organic tracers for biomass burning, food cooking, biogenic emissions (e.g. pollens and fungal spores), and secondary organic aerosols. Data analysis will focus in quantifying these source contributions and characterizing the local impacts of anthropogenic activities.

46. SEPARATION OF FATTY ACIDS USING NANOPOROUS MEMBRANES

Ned B. Bowden and Abhinaba Gupta
University of Iowa

Over 140 million tons of vegetable oils are produced each year, and most of these oils are sold as food for people or animals or burned as biodiesel. Surprisingly, few applications of oils or their fatty acids in the chemical industry exist despite their low cost. The reason for the lack of applications is that the fatty acids are isolated as mixtures of five or more fatty acids that are challenging and expensive to purify. Simply, a mixture of fatty acids is inexpensive, but a solution of a pure fatty acid is expensive. We recently developed a method to purify fatty acids using organic solvent nanofiltration membranes. The use of membranes is important because separations based on them are inexpensive and readily scaled up in industry. These membranes separate molecules based on their sizes; large molecules do not go through the membranes but small ones readily pass through the membranes. All of the fatty acids quickly passed through our membranes, but we discovered that the addition of amines kept the cis-fatty acids from permeating. The amines formed salts with the fatty acids, and the salts were large enough to be differentiated by our membranes. This talk will explain the concepts behind this method and how the fatty acids derived from soybean oil were separated.

47. IONIC CONDUCTIVITY STUDIES OF LiBOB-BASED 1ND2/1NM2 ELECTROLYTES FOR LITHIUM-ION BATTERY APPLICATIONS

Wilfried V. Barth and Leslie J. Lyons
Grinnell College

LiBOB was dissolved in a binary solvent of 1ND2 and 1NM2 of varying compositions and their solutions were measured for ionic conductivity at -10 to 50 °C using AC impedance spectroscopy. Conductivity was found to rise with increasing salt concentration and increasing 1NM2 content. Increasing 1NM2 concentration increased conductivity equally across the given temperature range. All the electrolytes produced conductivities above the 1.0 mS/cm threshold required for commercial application.

48. THE TRANSPORT OF IONIC SPECIES IN SILYL SOLVENTS BY NMR SPECTROSCOPY

Claire Williams and Leslie J. Lyons
Grinnell College

Diffusion of 1-H, 11-B, and 7-Li in 1ND2 and LiBOB at various concentrations was studied using NMR spectroscopy. A Pulsed-field-gradient Spin-echo pulse program was used to measure diffusion. It was found that the electrolyte system of 1ND2 and LiBOB has a higher degree of dissociation than carbon analogues triglyme and diglyme. The transference numbers for the 1ND2 system were between 0.35 and 0.45 for the cation. The rate of diffusion increased with temperature and an effort was made to reduce the influence of convection on the proton diffusion coefficients. Proton was the fastest diffusing species followed by boron and lithium. The more dilute sample was the fastest diffusing for all species and at all temperatures.

49. SYNTHESIS OF 4-PHOSPHO-METHYL GLUCOSE

Shelbee M. Ellison and Corbin J. Zea
Grand View University

Glucose phosphates play an important role in many biological pathways, and are most commonly found as the biologically active forms of glucose-1-phosphate and glucose-6-phosphate. In this study, we present the synthesis of the 4-phospho- α -D-methyl glucopyranoside through carbohydrate chemistry techniques starting from the commercially available α -D-methyl glucopyranoside.

50. SYNTHESIS OF 4-PHOSPHO-MALTOSE

Michael W. Wignes and Corbin J. Zea
Grand View University

Glucose phosphates play an important role in many biological pathways, and are most commonly found as the biologically active forms of glucose-1-phosphate and glucose-6-phosphate. In this study, we present the synthesis of the 4-phospho-maltose through carbohydrate chemistry techniques starting from the commercially available maltose.

Ecology & Conservation Section Poster Presentations

51. MANAGEMENT OF NON-NATIVE, INVASIVE *PASTINACA SATIVA* (WILD PARSNIP) USING MULTIPLE CONTROL METHODS

Andrew Bentz and Molly McNicoll
Luther College

Mortality of non-native, invasive species can result from targeted death of the entire plant, but also by methods that damage regrowth, by severing active growth from resources stored in roots. Monocarpic perennial species may be more vulnerable to loss of stored resources, especially if treated after flower-stalk bolting, when a majority of resources are stored aboveground and root resources are no longer available to the growing plant. *Pastinaca sativa* is a monocarpic perennial and problematic invasive species in Iowa grasslands, but quantitative tests of its effective control are rare. To compare management methods, we applied three alternate control measures to *P. sativa* after flower-stalk bolting: systemic herbicide; root cutting that separated aboveground vegetation from the root below the soil surface; and scything that removed most aboveground vegetation, but did not sever the root. Abundance of *P. sativa* was measured before and after treatments in 10 x 5 m treatment plots. After two years of treatments, abundance of *P. sativa* was significantly reduced in all treatments, with little difference among treatment type. Our results support that severing above ground vegetation from stored resources in roots can have similar results as use of herbicides.

52. *PARAMECIUM CAUDATUM* POPULATIONS AFTER EXPOSURE TO *TYPHA LATIFOLIA* OR *LYTHRUM SALICARIA*

Joanna S. Blomquist, Annette N Dean, Alicia C Long, and Paul E. Weihe
Central College

Purple Loosestrife (*Lythrum salicaria*) is an exotic plant of concern to wetland managers, and considerable funds and effort have been expended to control the species. However, few studies have attempted to quantify its ecological effects. We exposed the common Protist *Paramecium caudatum* to water with tissue samples of either Loosestrife; a common competitor, the native broad-leaved Cattail (*Typha latifolia*); or control (no added plant tissue). Plant tissues were divided into a portion near the top, bottom (beneath the usual water line), or belowground (root or rhizome); five replicates of each portion for each species, were placed in individual Petri dishes plus five control dishes for a total of 35 dishes. Well-mixed 3-mL samples of water from the *Paramecium* culture were

added to each dish, and counts recorded immediately, after 2 days, 3 days, and 7 days. *Paramecium* were cultured successfully in all dishes; counts were 9% higher in Cattail than Loosestrife, but this difference was not statistically significant (Kruskal-Wallis $H = .26$, D.F. = 2, $p = .877$). We found no evidence that *Paramecium* exposed to any portion of either plant were different from those in the control. This study therefore does not provide support for an impact of Loosestrife on this Protist.

53. A SURVEY OF TREES AND TREE HEALTH AT THE WEST UNION RECREATION COMPLEX

Dan Figdore, Scott S. Figdore, and Jennifer L. Stoffel
Upper Iowa University

Trees planted within the last ten years at the West Union Recreation Complex (WURC), in Fayette County Iowa, were observed to be unhealthy and dying. The trees on the 40-acre complex were surveyed and mapped to determine if there was a difference in relative tree health between trees in established areas of the complex and trees in the newly landscaped areas. In late fall of 2011, information was recorded for each tree in the WURC, including tree species, tree height, and tree diameter at breast height. A Garmin Venture HC was used to mark tree locations. In the summer of 2012, a categorical rating of the health of each tree in the park (healthy, unhealthy, or dead) also was recorded. The park was divided into ten sections, including three sections where soil was known to be undisturbed (established) and seven sections where the topsoil had been disturbed within the past ten years (newly landscaped). A homogeneity Chi-square test was performed to compare the percentages of healthy, unhealthy, and dead trees in the established sections versus the newly landscaped sections. The combined established sections of the park had a significantly higher percentage of healthy trees at 86.4% compared to the combined newly landscaped sections at 65.8%. In one section containing athletic fields, where the removal of surface horizons appears to have occurred during landscaping, only 20.7% of the 135 trees were rated as healthy. Two additional sections also showed particularly poor tree health, with 34.3% of the trees surveyed in these combined sections rated as either unhealthy or dead. Implications of the study, including considerations for future tree planting in the WURC, will be discussed.

54. THE RELATIONSHIPS BETWEEN SPECIES RICHNESS AND BOTH REMNANT SIZE AND LEAFY SPURGE INVASION IN WINONA GOAT PRAIRIES^{BBB}

Mary Gerty and Moni Berg-Binder
Saint Mary's University of Minnesota

Goat prairies are a unique and extreme habitat centered on the southwestern sides of bluffs along major rivers in the driftless area of the upper Midwest. Characteristic steep slopes, thin soils, and intense exposure to the sun and wind create a warm and dry microclimate. These harsh conditions have generally helped to preserve goat prairies while other more invasible prairies have

diminished. However, in recent human history goat prairies have begun shrinking in size as woody shrubs invade inwards from the edges shading the ground, increasing the soil moisture, and decreasing the temperature. Although goat prairies have decreased dramatically in both size and frequency, they continue to support a unique community of plants and animals. During the summer of 2012, the plant communities, size of prairie remnants, and presence and cover of leafy spurge were surveyed in 10 Winona goat prairies. Results have shown that native species richness is positively correlated with prairie area and negatively correlated with percent leafy spurge cover. Surveys of the understudied arthropod communities of goat prairies were also performed. Insects and similar arthropods fill many important niches including scavenging, herbivory, and predation and serve as an important source of prey for larger animals. Arthropod communities of local goat prairies were sampled using 48-hour pit traps in order to better understand the taxonomic groups and functions represented in this habitat and to begin a collection of properly curated voucher specimens for future educational purposes.

55. COMPETITIVE ABILITIES OF NATIVE AND INVASIVE SPECIES IN THE MOJAVE DESERT

Cara Gula, Erika Mudrak, and Kirk Moloney
Iowa State University

In the desert southwest invasive species pose as a major threat because they can outcompete native species and provide fuel for wildfire. In the Mojave Desert native plant species exhibit a patchy distribution, due to the evenly spaced distribution of shrubs, resulting in a soil nutrient gradient. Nutrients are highest under the shrub canopy and decline in concentration into the interspace, creating *fertility islands*. Annual plant species, both native and invasive, respond differently to fertility islands. While invasives can survive in the interspace, natives often thrive at higher nutrient levels (directly under the shrub). To test competitive abilities of invasive and native species along the nutrient gradient, we investigated the relationship of available area (determined by Thiessen polygons) to plant biomass. We expected that higher nutrient levels would allow growth of more natives which should then outcompete the invasives. Alternatively, invasives will thrive and outcompete natives in the lower nutrient soil. In a greenhouse study, we investigated the competitive relationship between native and invasive species at three nutrient levels. These nutrient levels were chosen to represent specific parts of the nutrient gradient. Two native species (*Phacelia distans* and *Lasthenia californica*) and two invasive species (*Bromus rubens* and *Schismus arabicus*) were planted and then monitored for 14 weeks to test competition of among the natives and invasives. Surprisingly, species thrived better in the low and medium nutrient levels, which showed three fold more growth than that of high nutrient level. At all nutrient levels, invasive species persisted in the experiment long after native species died. This could indicate that invasive species have the capacity to thrive under any of these nutrient conditions. We did not find a strong correlation between biomass and plant available area in plant populations at week 1 and week 6, indicating that self-

thinning did not occur in these greenhouse populations.

56. IMPACT OF BT CORN LEAF DETRITUS ON AQUATIC MACROINVERTEBRATES

Jennifer Heim, John Killpack, and Melinda Coogan
Buena Vista University

In agricultural regions, freshwater systems are energized by crop detritus. The increasing presence of transgenic crops means an increasing level of transgenic detritus enters freshwater systems, potentially affecting non-target organisms. This study combines field and microcosm procedures to evaluate possible negative impacts of detritus from corn that expresses crystalline (Cry) proteins from the soil bacterium *Bacillus thuringiensis* (Bt) on benthic macroinvertebrate members of the order Trichoptera, which are related to Bt target organisms of the order Lepidoptera. Trichoptera, as shredders and water quality indicators, are used to evaluate healthy wetland systems. The field study, performed during fall 2011, compared decomposition rates of Bt versus non-Bt corn leaves by submerging 80 g leaf packs of pre-dried Bt and non-Bt leaves along Outlet Creek, Iowa at UTM Coordinates Zone 15T 0322289E 4718804N. After two months, the dry mass of leaf packs were shown to be statistically significantly different ($p = .0039$) with Bt corn leaves averaging a 25% higher mass. Additionally, a microcosm survivability study of Trichoptera larvae, initiated on July 19, 2012, has resulted in 100% survivorship in the non-Bt tanks and 78% survivorship in Bt tanks. Continued growth studies will be completed during fall 2012.

57. SEASONAL VARIATION IN OSTRACOD POPULATIONS IN A NORTHWESTERN IOWA FEN

Johnathan Hill, Nicole Hanish, and Richard Lampe
Buena Vista University

A fen in Buena Vista County, Iowa was sampled periodically during spring 2012. Populations were counted at surface and, when possible, 5 cm increments to a depth of 15 cm. Populations were present at times when the fen had minimal flow. Increased depth of water later in the spring produced larger populations at increased depths.

58. ASSESSING THE GENETIC DIVERSITY OF REDISCOVERED AEGLA CRABS OF PARAGUAY USING RAPD ANALYSIS

Lea Kieffer¹, Andrew Satterlee², Rasika G. Mudalige-Jayawickrama¹, and Gerald L. Zuercher¹
University of Dubuque¹, University of Florida²

The family Aeglididae is composed of freshwater anomuran crabs with a single extant genus, *Aegla*. *Aegla* are endemic to the freshwater streams in temperate and subtropical South America. In Paraguay, only a single aeglid species has been documented and the species was suggested to be extinct in 1999 (Kochalka et al.).

The rediscovery of *A. platensis* at several sites within the Mbaracayú Forest Natural Reserve and surrounding Mbaracayú Forest Biosphere Reserve in eastern Paraguay occurred in June of 2009 and many specimens were documented and collected from May through August of 2010 (Satterlee et al.). It is suggested that the collected *Aegla* specimens might represent different species or at least different ecotypes within *A. platensis*. The main goal of our research is to study the molecular systematics of Paraguayan *Aegla* specimens in order to understand the genetic diversity and species distribution. Genomic DNA extraction method was optimized to isolate intact DNA from preserved specimens. Random Amplified Polymorphic DNA (RAPD) method is currently being used to prepare a data matrix to determine the genetic relationships. We have optimized the conditions for Polymerase Chain Reaction (PCR) to get consistent band patterns on RAPD analyses. A Binary matrix is developed using the absence and the presence of bands. We will present the geographic distribution and the genetic relationships of the *Aegla* specimens and discuss the possibility of identifying different species and ecotypes based on our results.

59. A SURVEY OF TREE DIVERSITY IN THE VOLGA RIVER STATE RECREATION AREA

John T. Lee and Scott S. Figdore
Upper Iowa University

The Volga River State Recreation Area (VRSRA) in Fayette County is a 5,700-acre area located in northeast Iowa. Geographically the VRSRA is characterized by large limestone slopes and contains a portion of the Volga River. According to the General Land Office, approximately 95% of the area within the VRSRA was timber in 1948. A tree survey was performed in a small section near the river in the VRSRA in order to compare species diversity and distribution to nearby Bixby State Park and Preserve (Bixby), a 184-acre area in Clayton County which has been documented for its plant diversity and species richness. A section of the VRSRA was surveyed for trees in fifteen 25 x 25 m test plots. Five random plots were identified in each of three types of terrain: a floodplain area, a sloped terrain area, and an upland area. In each plot, every tree greater than 2 inches in diameter at breast height was identified, counted, and recorded. Comparisons of tree diversity data from this study were made with similar data from Bixby (Norris and Lewis, 2006) for each of the three types of terrain. In many cases, common tree species were found associated with similar terrain from both parks. For example, floodplain areas in both parks contained black walnut (*Juglans nigra*) and hackberry (*Celtis occidentalis*), which were not common in sloped or upland terrain. However, differences were also apparent, such as the prevalence of sugar maple (*Acer saccharum*) in the floodplain plots of VRSRA, but which was not noted in the floodplain forest in the Bixby inventory. Comparisons of the VRSRA data to an early study of plant diversity in northeast Iowa (Geiser, 1918) will also be discussed.

60. POPULATION DYNAMICS AND HYBRIDIZATION OF ICTIOBIUS SPECIES IN STRAIGHT SLOUGH, MISSISSIPPI RIVER, POOL 6^{BBB}

Clinton Nienhaus and Josh Lallaman
Saint Mary's University of Minnesota

The genus *Ictiobus*, commonly referred to as Buffalo, are a group of large, deep bodied fishes belonging to the family Catostomidae. In Minnesota there are three members of the *Ictiobus* genus: the black buffalo, bigmouth buffalo, and smallmouth buffalo. Habitat alteration and degradation in the Mississippi River has resulted in population changes to many native species, including buffalo. Instances of hybridization have been documented within the populations of buffalo co-inhabiting the Mississippi River and could result in further population changes or decline. A study completed by Konrad Schmidt and Nick Prolux with the Minnesota DNR has suggested that the black buffalo population, as a whole, has been dwindling across the state and recommended that the black buffalo be moved from the protection listing of special concern to threatened. The objective of this study was to determine the population dynamics of the buffalo species and relative frequency of hybridization in Straight Slough. Adult buffalo were sampled using large mesh (4", 5", and 6" bar mesh) monofilament gill nets set in the summer and fall of 2012. Condition, age, and relative abundance of buffalo were used to characterize overall population status. I measured 12 morphological characteristics to categorize species traits and look for possible hybridization. Genetic samples were also taken from all fish and will be analyzed for differences between species. Data was collected from 23 bigmouth buffalo, 17 black buffalo, 4 smallmouth buffalo, and 2 suspected hybrids. Preliminary ages of the fish show a range from 3 to 17 years with an average age of around 10 years. Two of the 17 black buffalo were suspected hybrids based on intermediate morphologic characteristics. Results of the genetic analysis are currently pending and will help to determine the degree of hybridization occurring between the three species. This study will enhance the current information on population status and hybridization of the black buffalo in the Mississippi River and perhaps aid in further knowledge of this little known fish. My analysis should also help to provide key identification characteristics as well as show genetic relationships which can be used to monitor individual buffalo populations.

61. THE EFFECT OF EASTERN REDCEDAR ON SOIL PROPERTIES IN A NORTHWEST IOWA PRAIRIE

Olivia Norman and Todd Tracy
Northwestern College

Eastern Redcedar is a conifer native to the eastern U.S. that has become an insidious invader of prairie communities in the Midwest, including prairie pastures at Inspiration Hills Camp and Retreat Center in northwestern Sioux County, Iowa. Most of the redcedars were removed from the pastureland during summer 2010. To assess the effect of redcedars on the moisture and carbon content of soil at Inspiration Hills, we collected soil samples at 0 m, 5 m, and 15 m from redcedar trees, redcedar stumps, and

non-cedar control trees. We found that soil beneath non-cedar trees was higher in moisture content than soil 5 m and 15 m away, while the pattern was non-existent for redcedar trees and redcedar stumps. Furthermore, soil beneath (0 m) and 5 m from non-cedars was higher in moisture content than soil beneath and near redcedar trees and stumps. We also found that soil beneath non-cedars was higher in organic content than was soil 5 m and 15 m away, while the pattern was non-existent for redcedar trees and stumps. Likewise, soil beneath and near non-cedars (0 m, 5 m, and 15 m) was higher in organic content than soil beneath and near redcedar trees and stumps. Although we did not find decreased carbon and moisture content in soil beneath redcedars compared to the surrounding soil, we found that redcedars did not have the positive effect on soil moisture and carbon content that non-cedar trees exhibit.

62. ANALYZING THE POTENTIAL FOR INBREEDING AND OUTBREEDING DEPRESSION IN BUTTERFLY MILKWEED (*ASCLEPIAS TUBEROSA*) ON IOWA NATIVE PRAIRIES^{ISF}

Jeffrey T. Ploegstra, Brittany De Ruyter, Zack Petersen, Kayla Graves, Michelle Alkema, and Tony Jelsma
Dordt College

Isolated in a few remnants, less than 1% of Iowa's original tall grass prairie remains. Reduced population sizes increase the risk of lost genetic diversity and inbreeding depression potentially making populations more susceptible to environmental challenges. Due to concerns regarding the possibility of inbreeding and outbreeding depression, we investigated the population genetics of butterfly milkweed (*Asclepias tuberosa*) from 4 remnant prairies, an out-of-state seed supplier, and a prairie restoration project on the campus of Dordt College. Butterfly milkweed is desirable for evaluating the genetic structure of prairie populations because it is relatively abundant, easily identifiable, and often a component of conservation reserve program seed collections (Ion Exchange, Inc., 2009). Additionally, ten microsatellite loci in common milkweed (*Asclepias syriaca*) had earlier been identified (O'Quinn and Fishbein, 2008). We were able to establish the viability of these markers for work with butterfly milkweed. We looked for evidence of inbreeding by comparing the allelic and genotypic frequencies within the populations. We examined the overall allelic variability within and across remnant populations to evaluate the degree of genetic distinctiveness of remnant prairies. We also compared the allelic composition of populations from remnant prairies and those containing seed originating outside the state of Iowa as a measure of the potential for outbreeding depression. Greater insight into population structure, the prevalence of inbreeding, and the potential for outbreeding depression is critical for land managers to make appropriate decisions in the face of continued habitat loss and fragmentation.

63. LICHEN BIODIVERSITY IN SOUTHEAST IOWA

Amy Podaril and Jim Colbert
Iowa State University

Our research objective is to develop a thorough inventory of lichen species of southeast Iowa, an area of the state with quite limited documentation on lichen diversity. Collections are made from several sites differing in landscape features and habitats, some of which are rare for Iowa. The sites selected for inventory are Big Sand Mound (Louisa County), Starr's Cave State Preserve (Des Moines County), Shimek State Forest (Lee County), and Wildcat Den State Park (Muscatine County). Documentation of habitat, associated species, as well as georeference data will be recorded for each specimen. Initial collections are in the process of being identified and will be archived in the Ada Hayden Herbarium. Once all specimens are identified, the species list for each location will be compared to the currently known diversity of lichens in Iowa. This information is important because it may lead to identification of species newly reported for the state, as well as identification of species that may be candidates for Iowa's threatened and endangered species list, or may be extirpated from the state.

64. HOME RANGE, HABITAT USE, AND MORTALITY OF HATCHLING AND JUVENILE ORNATE BOX TURTLES (*TERRAPENE ORNATA ORNATA*) IN IOWA

Kodey Salow¹, Taylor Helms¹, Rachel Fendrich², Chelsea Arnold², Andrew McCollum², Neil Bernstein¹, and Sara Doermann
Mount Mercy University¹, Cornell College²

The ornate box turtle (*Terrapene ornata ornata*) is threatened in Iowa. The species' prairie habitat has mostly been converted into agricultural land, reducing and fragmenting natural habitat; increasing contact with motor vehicles and farm implements; and most likely with mesopredators like raccoons, which thrive around humans and edge habitats. Our long-term project strives to understand the ecology and natural history of the second largest population of *T. ornata* in Iowa and provide information to management agencies to help develop conservation plans for this species. Perhaps the largest gap in our knowledge of ornate box turtles pertains to the biology of juveniles or hatchlings, as they are both uncommon and secretive. With the advent of miniature radio telemetry transmitters we have begun monitoring hatchling and juvenile turtles to obtain data on home range, habitat, and microhabitat. I will discuss the results from our first two years of efforts at tracking hatchlings and juveniles. We tracked 19 adult turtles, 12 hatchling turtles, and 9 juvenile turtles in the Hawkeye Wildlife Area in Johnson County, Iowa, during the summers of 2011 and 2012 using radio telemetry. We recorded each turtle's GPS coordinates daily and calculated their home ranges using 95% fixed kernels and minimum convex polygons. In addition, we gathered data on mortality, habitat, and microhabitat used by these turtles. Mean adult weekly and monthly home ranges were consistently larger than weekly and monthly juvenile and hatchling home ranges. Juvenile home ranges were consistently larger than hatchling home ranges. Habitat and microhabi-

tat preferences varied based on age. Juveniles were far more likely than either adults or hatchlings to be found in a forest habitat, while hatchlings were more likely to be found in prairie. No age group spent more time in agricultural fields, even though the nesting area was within 100 meters of agriculture. Hatchlings were far more likely to be found buried than were juveniles or adults. While our sample remains small in both number of individuals and duration of individual observations for hatchlings, it appears that compared to older turtles, hatchlings have smaller home ranges and use fewer different habitat types. This may simply reflect reduced movement compared to older turtles. If they do not move far from the nesting site in the first month after emerging, they will encounter mostly prairie habitat. The reduced movement may reflect simple size scaling of movements or a greater need to remain underground to avoid predators or high daytime temperatures. During 2011, one hatchling died from human causes; during the summer of 2012, all seven of our hatchlings were preyed upon within two months of the time we began tracking them. While it remains unclear whether predation on nests, hatchlings, and juveniles is artificially high at our site, predation on early life stages is substantial; our data suggest that the nesting site and the immediate surrounding area might be an appropriate and cost-effective focus for conservation measures.

65. FEEDING PREFERENCES OF ANAS PLATYRHYNCHOSIS COLLECTED DURING MIGRATION NEAR SWEET MARSH WILDLIFE MANAGEMENT AREA, IOWA

Jake Sieverding and Jennifer L. Stoffel
Upper Iowa University

Understanding the feeding habits of mallard ducks (*Anas platyrhynchos*) is crucial to ultimately providing the necessary elements needed throughout the winter migration. Studies have been conducted to obtain better knowledge of mallard feeding habits in various states across the U.S.; however, to our knowledge few feeding studies have been done in Iowa or on state managed lands. This study used food material found in the esophagi of mallards to determine if mallards preferred planted (agricultural) or non-planted (native) food sources. The hypothesis for this study was that mallards consume more agricultural crops such as corn and soybeans than natural foods. Mallards were collected by hunting and harvesting at Sweet Marsh Wildlife Area in Tripoli, Iowa. Collection of mallards was done from October 13, 2012 through November 14, 2012. The esophagi were removed, frozen, and then taken into a lab at Upper Iowa University where the contents were collected and identified. Esophagi contents were oven dried at 55 °C for 5-6 days and weighed. Data of esophagi content were analyzed using a paired t-test in Minitab Version 16 to compare the weight of food consumed by mallards between planted and non-planted food sources. Analyses showed no significant differences between non-planted and planted foods ($p = .888$).

66. OBSERVATIONS OF SUMMER TRICHOPTERAN POPULATIONS IN A DROUGHT STRICKEN LAKE IN NORTH-WESTERN IOWA

Andrew Smith, Sheila Narh, Raisa Bucheli, and Richard Lampe
Buena Vista University

Trichopteran populations were examined during June and July, 2012, in Storm Lake, Iowa. Plastic boxes open to lake water and held in place with rock were used to sample three different sites along the lakeshore (north, south, and west shorelines). Weekly, the caddisfly larvae found on the inner side of the lid were counted and removed. Severe drought rapidly lowered lake levels causing our study to end prematurely in July. We observed a steady decline in trichopteran populations throughout the two month period.

67. A SURVEY OF TREE SPECIES IN ECHO VALLEY STATE PARK

Katie M. Steffen and Scott S. Figdore
Upper Iowa University

Echo Valley State Park (EVSP) is located among Northeast Iowa's scenic bluff topography just east of West Union in Fayette County. EVSP is a 100-acre forested area containing two trout streams, a picnic area, and a campground. An extensive plant inventory at EVSP is currently ongoing, and results (unpublished) suggest that the park possesses an impressive diversity of plant life. The purpose of this study was to compare the diversity of tree species in various terrain areas of EVSP with published information from a plant inventory of Bixby State Park and Preserve (Bixby). Bixby has been well-documented as a location having considerable plant diversity. To date, 75 x 25 m sections were surveyed in each of three terrains: a floodplain area, a sloped terrain area, and an upland area. All trees 6 inches or larger in diameter at breast height were identified by species, counted, and recorded in each section. The EVSP results were compared to published results from Bixby (Norris and Lewis, 2006) to determine whether any notable differences in tree species diversity were evident between similar terrain areas of the two parks. For example, in this study, it was noted that basswood (*Tilia americana*) and elm (*Ulmus spp.*) were more commonly found in floodplain terrain of both parks, whereas white ash (*Fraxinus americana*) was common in the EVSP floodplain, but not noted in the forest floodplain of the Bixby inventory. Comparisons of the EVSP data to an early study of plant diversity in northeast Iowa (Geiser, 1918) were also performed.

68. DOES EUROPEAN BUCKTHORN AFFECT THE DISTRIBUTION OF ANURANS IN A GALLERY FOREST

Todd Tracy and Olivia Norman
Northwestern College

This study explored the effects of the invasive shrub European buckthorn (*Rhamnus cathartica*) on amphibian abundance and

distribution in Northwestern College's riparian forest near Alton, Iowa. While pitfall trapping for invertebrates in treatment plots (where buckthorn shrubs and trees had been removed) and control plots (left alone), we unintentionally caught 131 American Toads and 7 Northern Leopard Frogs. We found no significant difference in the number of amphibians trapped between treatment and control plots, nor did we find a significant relationship between buckthorn density and amphibian density in control plots. Although buckthorn appears to have negatively affected populations of amphibians such as spotted salamanders and wood frogs in other regions, we found no evidence that buckthorn negatively impacts habitat use by American Toads and Northern Leopard Frogs in our forest.

69. WIND AND GEESE AS VECTORS FOR ZOOPLANKTON DISPERSAL: HOW MANY ZOOPLANKTON DOES IT TAKE TO START A COLONY^{BBB}

Shawna Marie VanMeighem, Logan James Shaw, Savannah Marie Pike, and Johanna Foster
Wartburg College

Aquatic ecosystems rely on a balance of organisms to maintain their food web. Zooplankton provide a link in this balance between photosynthetic algae and larger, carnivorous fish. Due to their importance in the ecosystem, it must be understood how these microscopic organisms disperse between bodies of water. Some research has demonstrated that zooplankton are passively dispersed via wind and waterfowl; however, more data are necessary to further understand the methods of dispersal and successful colonization. We hypothesized that *Daphnia spp.* and *Cyclops spp.* could disperse via wind and waterfowl and could then establish a colony. We predicted that more *Daphnia spp.* than *Cyclops spp.* would be dispersed via wind and waterfowl based on morphology. *Daphnia spp.* reproduce parthenogenetically, and *Cyclops spp.* reproduce sexually; therefore, we predicted that an individual *Daphnia spp.* or two individual *Cyclops spp.* would be sufficient numbers to start respective colonies. In the field, three collection tanks were placed at three distances with the pond's edge as zero meters to monitor for wind dispersal. Additionally, to determine if waterfowl transport living zooplankton wild geese were herded into pens and washed with zooplankton-free groundwater. In the lab, four sets of four replicated beakers were filled with groundwater and set numbers, from prior research, of living zooplankton were introduced into each colony to determine if colonization after dispersal was viable. Data supported the prediction that *Daphnia spp.* and *Cyclops spp.* could be dispersed via wind and waterfowl, but there were no significant differences between dispersal rates. Colonies of zooplankton were successfully established using the predicted minimal numbers.

E cology & Conservation Section Oral Presentations

70. EFFECT OF VEGETATION DIVERSITY AND STRUCTURE ON THE COMMUNITY STRUCTURE OF SMALL MAMMALS WITHIN GRASSLANDS^{BBB}

Patty Lin
Bethel University

Native Prairies are highly diverse. In terms of grassland reconstructions, if the goal is to restore a productive habitat, it's important to take into account the value of increasing floristic diversity. The objective of this study was to look at the effect of the differences in vegetation (biodiversity and structure) on community structure of small mammals within grasslands. The Schottler Wildlife Management Area near Austin, Minnesota had four types of reconstructed grassland plots: lower diversity warm season grasses, lower diversity cool season grasses, higher diversity forbs, and higher diversity tall forbs. The variety of plots were ideally suited to comparing the effect of vegetational differences on small mammal communities. Animals captured included Meadow vole (*Microtus pennsylvanicus*), Prairie vole (*Microtus ochrogaster*), White footed and Deer mouse (*Peromyscus sp.*), Northern short-tailed shrew (*Blarina sp.*), Pygmy shrew (*Sorex hoyi*), Least weasel (*Mustela nivalis*), and Meadow jumping mouse (*Zapus hudsonius*). The Meadow and Prairie vole were the two most frequently captured species. The POPAN model within MARK was used to calculate population estimates. Based on these estimates, cool season grass plots supported the lowest number of voles relative to the other plot types. Both forb plots and the warm season grass plots reflected high capture rates of both vole species. Significant differences were found between cool season grasses and all other plots for Meadow voles ($F = 10.57, p = .00$). For Prairie voles, significant differences were found between warm season grasses and all other plots ($F = 30.00, p = .00$) and between cool season grasses and forbs ($F = 30.00, p = .01, .00$). As a whole, while voles may have a preference for some plots over others, this data set suggests they are adaptable across the plots. This supports the null hypothesis that an increase of vegetational heterogeneity will not correlate to an increase in small mammal abundance and diversity. The Shannon-Wiener Index values for all plot types were between 0.8-1.0, indicating relatively low small mammal biodiversity across all four plots. Trap and bait biases may have had an impact on the perceived total small mammal diversity.

71. WHAT AN URBAN PRAIRIE CAN TEACH US

Jimmie D. Thompson¹, Deborah Q. Lewis¹, and William R. Norris²
Iowa State University¹, Western New Mexico University²

The Ames High School Prairie/Richard W. Pohl State Preserve is a ~7 ha (17 acres), mesic-dry prairie/woodland complex located just west of the Ames High School within the Ames city limits, Story County, Iowa. Managed by The Nature Conservancy staff and local volunteers, it is best known for the ~4 ha (10 acres) of remaining prairie vegetation, while the woodlands have greatly expanded into the prairie areas in the last half-century. In the past decade, management efforts have partially re-expanded the prairie, but also created disturbed openings for nonnative weed establishment. Inventories of only the native prairie species were completed in 1965 and 1995. Comparisons of these studies and a complete inventory now underway (since 2010) are providing some clues of changes in prairie species composition. The current study is also documenting woody encroachment; recent establishment of a native, herbaceous, woodland species component; and introduced exotic species. To date, 444 vascular plant taxa (425 in the current survey) have been recorded from the preserve, with 11 of these as first reports as naturalized taxa in the state. The prairie is extensively used by Ames High School and Iowa State University biology and environmental science classes. The prairie is challenged by its small size, distance from similar prairies, difficulties in burning because of the urban setting, heavy public and student use, a stormwater drainage system that bisects the prairie through the woodlands, and its proximity to sources of introduction of ornamental species. Its future may also be jeopardized by expansion of the high school or further development of adjacent property and street extension.

72. BISON-MEDIATED SEED DISPERSAL IN A TALLGRASS PRAIRIE RECONSTRUCTION^{ISF}

Peter Eyheralde and W. Sue Fairbanks
Iowa State University

Bison have been considered keystone species in the evolution of tallgrass prairies due to grazing activities, but bison also have great potential to be effective seed dispersers. As part of a larger study, we report the seed composition found in bison dung and shed hair collected from the Neal Smith National Wildlife Refuge in south central Iowa. We hypothesized that seed species composition in fecal samples would be dominated by graminoid species, based on microhistological diet analysis from previous research at our study site. Shed hair samples were expected to contain a higher proportion of forb species than found in dung. Seed composition of both shed hair and dung appear to be influenced by forage selection by bison and the phenology of seed dispersal. Seeds were extracted and identified from 131 fecal samples collected monthly from May 2011 through April 2012. Bison dung contained a greater percentage of non-native species than native species, while the opposite was true in shed hair. Greater numbers of forb seeds per gram were found in winter dung samples, while dung samples collected during the growing

season contained mostly graminoids. Shed hair collected from April through November 2011 contained more grass seeds per gram than forbs. Over the entire year, greater numbers of grass seeds per gram of dung were found, but over half of the grass seeds were damaged by the digestive processes. By contrast, forb, sedge, and rush seeds were less common, but less damaged.

73. A MODEL OF INVERTEBRATE RICHNESS ON RESTORED PRAIRIES

Michael Frank, Courtney Sherwood, Lauren Tirado, Casey Becker, Heidi Berger, and Clint Meyer
Simpson College

We will present a differential equations model of prairie restoration. Here, species richness is considered as an indicator of prairie restoration, with the variables for the equation being invertebrate and plant species richness and time. We will incorporate field work from a prairie in Nebraska as an example of our model. Our main goal is determining if planting fewer seeds will yield similar invertebrate richness as planting more seeds.

74. PRAIRIE POWER: ARE SPECIES-RICH PRAIRIE RECONSTRUCTIONS AN IDEAL FEEDSTOCK FOR BIOENERGY

Dustin Graham, Daryl Smith, and Dave Williams
University of Northern Iowa

Our study explores the field-level application of prairie plantings as feedstocks for bioenergy. In 2009, reconstructions with four levels of species richness were planted with four replicates on each of three soil types. Treatments consisted of a switchgrass monoculture; a mix of 5 warm season grasses (big five mix); a mix of sixteen species including warm and cool season grasses, forbs, and legumes (biomass mix); and a mix of thirty-two species (prairie mix). We hypothesized that species rich plantings would produce more biomass and contain fewer weeds than less diverse plantings. Above-ground biomass was sampled from 2010 to 2012 by clipping ten 0.1 m² quadrats per plot. Statistical significance was assessed with PERMANOVA+ using treatment, soil, and year as factors with plots nested in soil and years. There were significant treatment and year ($p = .0281$) and soil and year interactions ($p = .0031$). In 2010, no treatments were significantly different. In 2011, diverse treatments produced more biomass than the big five treatment (vs. biomass, $p = .0145$; vs. prairie $p = .0121$). In 2012, the biomass treatment produced less than all other treatments on the most fertile soil (vs. switchgrass, $p = .007$; vs. big five, $p = .009$; vs. prairie $p = .013$), but no treatments were significantly different when considered over all soils. Biomass and prairie treatments had less weed biomass than the switchgrass monoculture ($p = .002$, $p = .001$). At this time, it is unclear whether diverse plantings produce more biomass than less diverse plantings, but there is evidence that diverse plantings will require less investment in weed suppression.

75. THE EFFECT OF PERIGYNIA REMOVAL AND STRATIFICATION ON GERMINATION AND FIELD EMERGENCE OF *CAREX BREVIOR* AND *C. MOLESTA*

Christina M. Boeck-Crew, Daryl Smith, Dave Williams, and Greg Houseal
Tallgrass Prairie Center at the University of Northern Iowa

Cold-wet stratification and perigynia removal have been shown to increase germination in some *Carex* species. Germination response of two native *Carex* species, *C. breviar* and *C. molesta*, were tested to cold-wet stratification (28 day) and perigynia removal. Seed treatments included unstratified with perigynia intact (control), unstratified with perigynia removed, stratified with perigynia intact, and stratified with perigynia removed. Four replicates of 100 seeds were held under a diurnal temperature regime (30/15 °C) with 12:12 hr (light:dark) for 60 days. Two separate trials were ran, testing both previously harvested stored seed and freshly harvested seed, adding *C. bicknellii* to the fresh seed trial. 1-way ANOVA statistical analysis of total (60 day) mean germination for all treatments of stored *C. breviar* and *C. molesta* revealed that stratification, perigynia removal and the combination of both significantly increased germination over the control ($p < .05$). Furthermore both species germinated as well with perigynia removal as with cold-wet stratification, with no additive effects of combining both treatments. Preliminary observations indicate differential effects among the treatments in the fresh seed as well. Additionally the effects of the treatments in the two species of stored seed were tested in field emergence; analysis of these results is underway.

76. INHIBITORY EFFECTS OF ACER SACCHARUM ROOT EXTRACT ON THE GROWTH OF RHAMNUS CATHARTICA^{BBB}

Christine Amber Carroll
Bethel University

Acer saccharum root extract appears to have an allelopathic effect on the growth of *Rhamnus cathartica*. This experiment tested concentrations of a 10 molar solution of *A. saccharum* root extract on the growth of *R. cathartica* from seed. A control group was given only distilled water (4 ml), experimental group 1 was given half the volume in of solute (2 ml) and half the volume of distilled water (2 ml), and the experimental group 2 was given the whole concentration of solute (4 ml). Each group contained sixteen test seeds. During the experiment the seedlings were monitored for rate of growth and time of germination. At the end of the experiment, the seedlings were measured for height; the wet mass was taken and then the dry mass was taken. The experiment ran for 3.5 months. Significant data was collected on the height with a p-value of .026. Further research still needs to be done to assess the effect of *A. saccharum* root extract on the growth of native plants and to determine if the test is an ecological solution for controlling the growth of *R. cathartica* in the wild.

77. COMPARING MACROINVERTEBRATE ASSEMBLAGES IN IOWA HEADWATER STREAMS THAT DIFFER IN SEVERITY OF AGRICULTURAL IMPACTS^{BBB} & ^{ISF}

Conor Grant Fair, Dianna Maye Krejsa, Brittany Kay Gochenour, and Clinton Kevin Meyer
Simpson College

Recent evidence suggests that land use in the Midwestern U.S. (e.g., fertilizer applications and tile drainage) has contributed to continental-wide issues such as hypoxic zones off the Gulf Coast. This phenomenon originates in headwater streams in agricultural landscapes. Relatively little attention has been given to small Iowa streams. Our objective was to compare water chemistry parameters and macroinvertebrate communities in relatively non-degraded (i.e., reference) sites with those considered to have high or low agricultural impacts. Agricultural streams are expected to have macroinvertebrate communities with lower diversity and higher average pollution tolerance values than reference streams. We sampled macroinvertebrate communities using bio-assessment protocols, artificial substrates, and quantitative Surber sampling in two reference sites, two lesser-impacted, and three highly-impacted agricultural streams. Initial analysis of bio-assessment samples showed that although neither macroinvertebrate richness ($F = 0.30$, $p = .758$) nor diversity ($F = 0.33$, $p = .739$) differed by stream type, average macroinvertebrate tolerance values were lower in reference sites than agricultural streams ($F = 10.99$, $p = .024$). These results suggest that agricultural streams have relatively diverse communities, but those communities are dominated by pollution-tolerant organisms. Analysis of other sampling techniques will likely further establish negative agricultural effects and might reveal important differences between sites experiencing high and low agricultural impacts.

78. ARTIFICIAL BANK STABILIZATION'S IMPACT ON THE MACROINVERTEBRATE POPULATION

Annette Purdy and Wyatt Hoback
University of Nebraska Kearney

Bank stabilization projects are implemented to manage sediment and nutrient runoff and to improve habitat. Artificial stabilization projects use rock, riprap, and matting to restore riverbanks. One example of such a project can be found in Pammel State Park near Winterset, Iowa, where erosion was causing concerns due to undercutting of the bank and degradation of fish habitat. This study will investigate the impact the recent bank stabilization project has had on the benthic macroinvertebrate population. Chemical testing will be taken to ensure that outside factors are not affecting the populations. The reconstruction site will be compared to a testing site 50 meters downstream and 100 meters downstream from the stabilization construction. If the bank stabilization has improved the sediment and nutrient runoff, then the number of macroinvertebrate species surveyed will show an increase.

79. PREPARING FOR THE ADVANCE OF WHITE-NOSE SYNDROME IN IOWA^{BBB}

Heather Sanders, Julie Blanchong, and Rebecca Christoffel
Iowa State University

Since its discovery in 2006, white-nose syndrome (WNS) has caused the death of millions of bats and infected more than 100 bat hibernacula throughout 19 states in the northeast and 4 Canadian provinces. This disease, caused by the fungal pathogen *Geomyces destructans*, infests caves and infects the exposed dermal tissue of hibernating bats causing frequent periods of arousal, the depletion of critical fat stores, and death. As it spreads westward, WNS has become a threat to the agricultural services bats provide through the predation of pest insects to communities throughout the Midwest, including the state of Iowa. This study uses Anabat SD2 detectors equipped with GPS to record bat calls and the locations of these calls along a series of drive transects throughout eight counties in Iowa. This data will serve as a foundation for the future monitoring of bat populations throughout Iowa, and to monitor the recovery of affected populations when WNS spreads to the state. Furthermore, the data can be used to identify areas in the state that are most likely to experience the greatest impact of WNS and take action to reduce such impacts.

80. RED-BACKED VOLES (*MYODES GAPPERI*) IN WINNEBAGO COUNTY, IOWA: PRELIMINARY RESULTS

Quinn A. Hesterlee and Paul E. Bartelt
Waldorf College

Does a population of the endangered Red-backed vole (*Myodes gapperi*) still reside in Winnebago County, Iowa? Populations of endangered species need to be monitored periodically to determine their status; biologists last tested for the presence of Red-backed Vole in this area in 2000. I am sampling two locations in Winnebago County for the presence of Red-backed voles. The first is a private 14.2 hectare wood lot 7.2 kilometers north east from Forest City, Iowa. The second site is Pilot Knob State Park, a state preserve that is located 6.8 kilometers east from Forest City, Iowa and 4 kilometers south from the private wood lot. I used three different trapping grids and Sherman box traps; each trapping grid consisted of 20 traps in a 4 x 5 arrangement. I trapped the private wood lot in December 2012 and positioned plastic covers (5-gal bucket cut in half lengthwise) over the top of traps to facilitate checking traps during heavy snows. Preliminary data suggests these covers also helped buffer extreme winter temperatures. Average (+SE) temperatures inside the traps (-1.3 ± 0.04) were slightly and significantly warmer than those outside the traps (-2.6 ± 0.6 ; $t = 65.28$, $p < .01$). So far I have trapped only the private wood lot; no Red-Backed voles were captured and the only small mammals present were deer mice (*Peromyscus maniculatus*). I plan to trap Pilot Knob State Park in March of 2013. Results will be presented.

81. WILL WOLVES RETURN TO IOWA

Ron DeArmond, Kristie Burns, Kyle Huber, Sam Satriis, and Tyler Stolz
Pella Wildlife Company

Pella Wildlife Company is researching the dispersal patterns of gray wolves that are part of the Western Great Lakes Distinct Population Segment (WGLDPS). Wolves have been confirmed in Missouri that are linked to the WGLDPS wolves. What dispersal patterns, if any, are wolves using that may include corridors through Iowa? Pella Wildlife Company is working with the Wisconsin Department of Natural Resources monitoring gray wolves and other carnivores native to the Midwest. Wolves have been confirmed in Crawford County, Wisconsin which is directly across the Mississippi River from Allamakee County, Iowa. When the river freezes it is very possible that wolves could cross from Wisconsin to Iowa. Delisting of the WGLDPS of wolves from the ESA, both Minnesota and Wisconsin have started management plans that include harvesting. Another question we are researching is will the added pressure from hunting disperse wolves into other parts of the Western Great Lakes region, which Iowa is a part of, and beyond? This study is in its first year and we are identifying Wisconsin packs of wolves that may have young disperse into Iowa. Tracking is currently underway which includes looking for signs of wolves in Wisconsin and Iowa where wolves are dispersing into. Future plans include tagging and collaring wolves as they move into counties across the river from Iowa. Our team of scientists will be monitoring patterns and mapping corridors used as well as possible territories that are established by dispersing wolves. At the time of the conference the winter tracking and mapping will be complete. We will have established packs to monitor as well as possible individual wolves that are dispersing or seeking packs to join. Surveys will also be complete for Northeast Iowa and a determination made if wolves have crossed over to Iowa during the winter season. Pella Wildlife Company staff for this project include a wildlife ecologist, animal scientist, anthropologist, predator tracker, and students from Iowa State University, all overseen by the CEO.

82. DO HYDRIC CONDITIONS DURING EMBRYONIC DEVELOPMENT IN THE FIELD INFLUENCE PHENOTYPES OF NEONATAL REPTILES

Brooke L. Bodensteiner¹, Timothy S. Mitchell¹, Jeramine T. Strickland², and Fredric J. Janzen¹
Iowa State University¹, U.S. Fish and Wildlife Service²

Embryos are highly sensitive to environmental conditions experienced during development. Many factors, including temperature, gas exchange, hormonal environment, nutrition available, and hydric conditions, can exert a major influence on phenotypic variation and survival. This is especially true in oviparous reptiles with flexible-shelled eggs that incubate in subterranean nests. In this study, we experimentally manipulated the hydric conditions of painted turtle (*Chrysemys picta*) nests. We used a reciprocal transplant design to split painted turtle clutches into two artifi-

cial nests adjacent to the maternally-selected nest; one nest served as a control and the other nest was watered to mimic a year with heavy precipitation. We placed a Thermochron iButton, programmed to record temperature hourly, in the center of a subset of the experimental nests and then measured the soil Volumetric Water Content of each nest before and after each watering event. Along with hatching success and incubation length, we examined hatchling traits potentially related to fitness: body mass, linear size [carapace length, carapace width, plastron length, and plastron width], and wet and dry mass of both the carcass and the residual yolk. With this experimental design, we assessed if we successfully created different abiotic environments in treatment nests and if soil water contents of nests in the field affect biologically meaningful traits of hatchling turtles. Findings from this study are in the expected directions according to previous lab studies and offer new insights into conditions in the field. We found that soil of watered nests had a higher Volumetric Water Content Percentage (VWC%) ($p < .001$) immediately after a watering event compared to control nests. Hatchlings from the watered nests were heavier ($p = .016$), and had wider carapaces ($p = .009$) and plastrons ($p = .011$) compared to hatchlings from the control nests. These hatchlings from the watered nests also had reduced wet and dry yolk masses ($p = .011$; $p = .012$ respectively) and enhanced dry carcass masses ($p = .03$). This experiment employed a novel approach to experimentally manipulating the hydric conditions of oviparous reptile nests in the field, to complement and enhance knowledge from prior experiments. These results have important ecological implications in suggesting that this abiotic variable affects hatchling phenotype, with ramifications for fitness, because growth and survival of neonatal turtles are positively affected by the size that they attain before hatching.

fall reactor and its dependence on six main variables in order to find the potential maximum dimensions of this kind of reactor for larger scale applications. CFD software was used to simulate the process inside of the reactor including fluid flow, heat transfer, and reaction global kinetics phenomena. This application will yield a useful overview of the performance of the reactor while modifying the variables based on a central composite design of experiments. A set of simple design criteria of free fall reactors will also be included as part of the outcome of this project.

84. IMPROVING THE QUALITY OF BIOMASS-DERIVED PYROLYSIS OILS WITH AN AUGER REACTOR

Tannon Daugaard, Fenglei Qi, and Mark M. Wright
Iowa State University

The objective of this research is the reduction of water content in chemicals from biomass fast pyrolysis oils. Biomass fast pyrolysis is a growing technology aimed to produce renewable fuels as a substitute to fossil fuels. We pyrolyzed up to 1 kg/hr of biomass in a lab-scale auger reactor at 550 °C using steel shot heat carrier. The system generates approximately 670 g/hr of bio-oil, 210 g/hr of char, and approximately 120 g/hr of non-condensable gases. Analysis of the bio-oil on gas chromatography/mass spectrometry (GC/MS) shows the bio-oil contains levoglucosan, acetic acid, furans (furfural, furfuryl alcohol), phenols, guaiacols (vanillin), and syringols. Karl-Fischer moisture content analyses differed between bio-oil fractions. The targets for this project are water contents of 6%, 14%, and 63% in the heavy phase, sugar-rich phase, and aqueous phase, respectively. The results from this project are compared to the predicted liquid, char, and non-condensable gas yields from a theoretical kinetic model.

85. FLEX FUEL POLYGENERATION: OPTIMIZING COST, SUSTAINABILITY, AND RESILIENCY

Matthew Kieffer, Tristan Brown, and Robert C. Brown
Iowa State University

Flex Fuel Polygeneration (FFPG) is a technology that employs multiple energy sources and produces multiple energy carriers to construct optimal energy plant designs in terms of cost, sustainability, and resiliency. This technology allows for adjustments to be made to market fluctuations and improvements to the energy efficiency and environmental performance of power plants. The diversification of energy pathways also increases resiliency to contingencies such as earthquakes, flooding, reduced winds, or other events that may reduce the availability of energy sources. In this study, we develop two FFPG plants that employ combinations of natural gas, biomass, and wind with the use of anaerobic digestion, different types of turbines, and Fischer-Tropsch synthesis. To obtain FFPG plant performance results, we combine techno-economic analyses available in literature of existing energy plants to reflect the FFPG plant designs. By doing high level analysis we can look at the costs and products of theoretical

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83. A CFD APPLICATION TO SCALE-UP A FREE-FALL REACTOR

Juan Proano Aviles and Robert C. Brown
Iowa State University

Free-fall reactors are simple configuration equipment that heat up a stream of inert gas and biomass particles that flow down through a heated pipe. Their objective is performing pyrolysis of the organic matter of the particles and obtaining a mixture of energy-rich and/or potentially upgradable solid, liquid, and gaseous products. The distribution of pyrolysis products highly depends on the temperature profile of the particles through the time of the process. Also, this profile is fully dependent on the dimensions and capacity of the reactor used. This study deals with the temperature evolution of the particles inside of a free-

plants and compare their performances to plants that are currently in operation. What we have found are preliminary results regarding the internal rates of return. Additional FFPG plants will be designed and analyzed at a high level to continue the advancement of this technology.

86. NUMERICAL MODELING OF PYROLYSIS PROCESS WITHIN AUGER REACTOR

Fenglei Qi, Tannon Daugaard, and Mark Mba Wright
Iowa State University

Auger reactors are a promising alternative for the conversion of biomass to transportation fuels via fast pyrolysis. The purpose of this study is to develop a numerical model that simulates the thermochemical evolving process of the biomass granular flow during fast pyrolysis. We assume that the biomass particles are well-mixed with steel shot (the heat carrier), the overall flow resembles a plug granular flow, and the particle has the shape of a sphere. The single particle mathematic model is then developed and used to predict the physics phenomena in the reactor. Initial results indicate that this model can qualitatively predict the production of pyrolysis oil, gas, and char. Comparisons with experimental data show similar trends for varying reactor-operating conditions. Simulation results are within 10% of the experimental results for bio-oil yield when the heat carrier initial temperatures vary from 798 K to 888 K, and they predict maximum yields of up to 70 wt% bio-oil. We envision that further development will allow for the design of novel reactor configurations for the efficient conversion of biomass to transportation fuels.

87. A COMPACT VERSATILE MICROBIAL FUEL CELL FROM PAPER

Luke T. Wagner and Nastaran Hasemi
Iowa State University

A new energy source will be needed in the near future to power our devices. Microbial Fuel Cells (MFCs) have shown some potential for creating energy but their adoption has been hindered. Some of the problems are that they don't provide enough power to work in some applications or that special equipment, such as syringe pumps, has been necessary to keep the fuel cells running. In this paper we propose a new type of microbial fuel cell that does not require a syringe pump to run properly. Paper-based microbial fuel cells are compact devices that don't need any external equipment to run. Paper-based microbial fuel cells are fabricated by layering chromatography paper with wax design printed onto it. This restricts the fluids to a specific flow path allowing it to act like the tubes in a typical microbial fuel cell device by delivering the fluids to the chamber. The fluids are picked up by tabs that sit in the fluid and use capillary attraction to flow up the tab and into the device. The fluids are directed to the chambers where the chemical and biological processes take place. These flows are then directed out of the device so that they are taken to a waste container and out of the system. Our μL scale paper-based microbial fuel cell creates a significant current

that is sustained for a period of time and can be repeated. A paper-based microbial fuel cell also has a fast response time. These results mean that it could be possible for a set of paper-based microbial fuel cells to create a power density capable of powering small low-power circuits when used in series or parallel.

88. COST-PRODUCTION IMPACT OF INCREASING WIND TURBINE TOWER HEIGHT

Huiyi Zhang and David Jahn
Iowa State University

A wind turbine tower height based cost production (HBCP) model is developed for engineers and developers to select the most cost efficient wind turbine for a specific wind farm. The model is designed by using Mean Value Theorem for integrals of wind power with respect to wind speed using high temporal resolution data rather than long-term averaging. The accuracy of the wind data ingested into the HBCP is studied through comparison of a modeled regional wind analysis to wind observations at hub height. The HBCP model is then used to explore the economic benefits of increasing hub height, which includes parameters like turbine type, tower height, and installation cost. The model computes changes to increased hub height in (a) installation cost, (b) Annual Energy Production (AEP), and (c) payoff period. In addition to optimizing tower height, the model also can be used to detect the maximum allowable generator capacity for the selected site. The accuracy of computing AEP is favorable compared to pertinent commercial models via reducing wind speed uncertainty, eliminating power curve uncertainty, and increasing the flexibility of integration intervals. A case study shows that by increasing hub height from 80 m to 100 m for a GE 1.5MW turbine at Homestead, Iowa, the mean wind speed increases 6.8%, the AEP increases 9.62%, and the payoff period is 4.4 years with a fixed power purchase rate of 6¢/kWh. With observed wind speed data at 150 m, the model shows that the maximized generator capacity reaches 6M.

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89. BIO-OIL DEOXYGENATION THROUGH CATALYTIC FAST PYROLYSIS IN A FLUIDIZED BED REACTOR

Yong S. Choi¹, Jing Zhang¹, Kyong-Hwan Lee², Robert C. Brown¹, and Brent H. Shanks¹
Iowa State University¹, Korea Institute of Energy Research²

Fast pyrolysis is considered a promising thermochemical technology for converting solid biomass into a liquid bio-oil that can be upgraded to valuable chemicals and transportation fuel. Unfortu-

nately, bio-oil from fast pyrolysis has lower energy density relative to petroleum fuels due to higher oxygen content. To overcome this issue, catalytic fast pyrolysis, in which a catalyst is used in-situ, has recently gained attention as an approach for bio-oil deoxygenation. While efforts have been made to explore the effect of catalysts on primary reaction deoxygenation in micro-scale pyrolysis reactors, it is also important to understand the influence of catalysts on bio-oil deoxygenation in bench scale reactors, which access primary reaction and the secondary reactions that become inevitable in industrial-scale pyrolysis systems. In this study, a 100 g/hr bench scale fluidized bed reactor was used to pyrolyze red oak with catalysts to produce bio-oil, non-condensable gases, and char. The catalysts selected for this study represented a range of acidity and basicity: aluminum oxide, silica-alumina, and magnesium oxide. The collected bio-oil was divided into a water-soluble fraction and a water-insoluble fraction by a water phase separation, and analyzed by various analytical instruments: GC-MS/FID, IC, HPLC, elemental analysis, and Karl Fischer. A comparison of the oxygen balance from the products from pyrolysis without and with the catalysts indicated that deoxygenation of bio-oil was achieved mainly by dehydration and decarbonylation. As a result, oxygen content in the dry bio-oil from catalytic pyrolysis with aluminum oxide and silica-alumina decreased from 16.7% to 11.0% and 9.7%, respectively, while oxygen content in dry bio-oil from catalytic pyrolysis with magnesium oxide remained the same.

90. NUMERICAL MODELING OF UREA INJECTION AND NO EMISSION IN A STOKER BOILER

Mohsen Ghamari and Albert Ratner
University of Iowa

The Selective Non-Catalytic Reduction (SNCR) of NO emission was investigated for a coal stoker boiler by establishing a comprehensive model in ANSYS FLUENT. Once a good accuracy of comprehensive model was achieved through comparison with experimental data, FLUENT Discrete Phase Modeling (DPM) was considered to simulate urea-water solution injection into the boiler. For this purpose, several injection rates, as well as different injection arrangements and velocities, were examined to characterize SNCR process. Results revealed the importance of the temperature zone to which urea is injected. A temperature window with maximum NO reduction while keeping the ammonia slip at its low levels was found to be about 1250-1420 K. It was also found that the nozzles closer to the corners of the wall are more likely to be in this temperature zone and would provide a more satisfactory result than injection through the middle or innermost ones. The results showed that injection from higher elevation could provide better result in terms of higher NO reduction and lower ammonia slip by means of a more even temperature profile and being closer to the flue gases. It was also found that, for the case of injection through middle nozzles and at the elevation of secondary air, urea should have high momentum in order to penetrate into the right temperature window and prevent a high amount of ammonia slip.

91. CELLULOSE-HEMICELLULOSE, CELLULOSE-LIGNIN INTERACTIONS DURING FAST PYROLYSIS

Jing Zhang, Yong S. Choi, Robert C. Brown, and Brent H. Shanks
Iowa State University

Cellulose, hemicellulose, and lignin are the major biopolymers in biomass and during their fast pyrolysis, each component generates distinct species, which leads to a complex chemical composition of the pyrolytic bio-oil. Given this complexity, complete chemical speciation with a high mass balance closure can provide insight into the underlying chemical mechanisms during fast pyrolysis. Previously, the pyrolysis behavior of the pure biopolymers was studied to examine their thermal deconstruction mechanisms. In the current work, the interaction effects between cellulose-hemicellulose and cellulose-lignin under fast pyrolysis conditions were determined by comparing the pyrolysis products from their native mixture, physical mixture, and superposition of individual components. A micropyrolyzer-GC-MS/FID and gas analyzer were used for online pyrolysis product analysis. It was found that no apparent interaction exists for either physical mixture or for the native cellulose-hemicellulose mixture. However, in the case of the native cellulose-lignin mixture the interaction effects depended on the type of biomass pyrolyzed. Herbaceous biomass exhibited an apparent interaction effect, represented by a diminished yield of levoglucosan and enhanced yield of low molecular weight compounds and furans. However, these interaction effects were not found for woody biomass. It is speculated that these results were due to a different degree of covalent linkage in these biomass samples.

92. BIOMASS PYROLYSIS AND GASIFICATION OF DIFFERENT BIOMASS FUELS

Eric S Osgood, Yunye Shi, Tejasvi Sharma, and Albert Ratner
University of Iowa

This work explores the gasification and pyrolysis of various biomass fuels such as crushed feed corn, rubber tires, oat hulls, and coal at temperatures between 400 °C and 600 °C. The evolution of hydrogen, carbon monoxide, carbon dioxide, and methane production from the biomass is measured as well as oxygen and relative humidity. The effect of moisture in the biomass was also investigated. To achieve the desired accuracy, a custom experimental setup was constructed with the lab scale gasifier to obtain time varying gasification and pyrolysis data at high heating rates. Biomass is dropped into a flow of heated nitrogen where the biomass thermally breaks down and releases various gases. A series of gas specific sensors measure the resulting species concentrations produced from the various biomass samples. The results show that pyrolysis occurs faster at higher temperatures and gasification is better achieved at lower oxygen concentrations, as expected. It was found that CO₂ and H₂O production increases with increasing oxygen concentration.

93. PARTIAL OXIDATIVE PYROLYSIS OF RED OAK USING A LAB-SCALE FLUIDIZED BED REACTOR

Kwang Ho Kim, Xianglan Bai, Robert C. Brown
Iowa State University

Partial oxidative pyrolysis of Red Oak using a lab-scale fluidized bed reactor was studied in this work. The influence of oxygen in carrier gas on distribution and properties of pyrolysis products was investigated with varying oxygen concentration, ranging from 0.525 to 8.40% (v/v) in carrier gas stream. It was found that total bio-oil yield stayed at a similar level (~ 62%) under varying oxygen concentration. The amount of carbon in bio-oil, however, decreased with increasing oxygen concentration, which was converted into non-condensable gases including CO and CO₂. The composition of bio-oil was analyzed using gas chromatography (GC), ion chromatography (IC) and high performance liquid chromatography (HPLC). It revealed that small amounts of oxygen (0.525 and 1.05%, v/v) could promote to produce monomeric phenols and sugars during pyrolysis. Also, the effect of oxygen on biochar properties was studied using several analytical techniques including elemental analysis, BET surface area, and FT-IR. From the morphological point of view, the results indicated that oxygen could oxidize some functional groups during oxidative pyrolysis, converting them into oxygen containing forms such as carboxyl or carbonyl groups. These findings coincide with the compositional analysis of bio-oil in that the concentration of phenolic monomers which contain ketone or aldehyde functional group in bio-oils produced from partial oxidative pyrolysis condition is high compared to control bio-oil.

94. MOISTURE IMPACT ON PAPER SLUDGE GASIFICATION

Tejasvi Sharma, Yunye Shi, Eric Osgood, and Albert Ratner
University of Iowa

Biomass gasification has become an area of key interest as a quick and direct way of converting materials into fuel sources. Biomass gasification is a process through which biomass is converted into gaseous products, tar, and dust. The purpose of the present work is to explore the gasification behavior of paper sludge with different moisture content. Paper sludge with different moisture content were tested. These tests were performed with temperatures ranging from 400 to 800 °C and at a pressure of 1 atm. Gasification data were obtained from a lab-scale up-draft gasifier. This setup includes an industrial heater, torch system, thermocouple, flow controllers, and the spark ignition system. The biomass samples were dropped into a flow of heated nitrogen where it was broken down and the respective gases were released. The gas was passed through a filter to remove any impurities and its composition was determined using a Gas Chromatography machine. It was seen that the paper sludge with different moisture content had a different gas evolution behavior.

95. MEASURING TRACE COMPONENTS IN SYNGAS USING GAS CHROMATOGRAPHY AND ION CHROMATOGRAPHY

Patrick A Johnston, Patrick Woolcock, Karl Broer, and Robert C. Brown
Iowa State University

Specific nitrogen and sulfur containing compounds are unfavorable in upgrading syngas to hydrocarbon based fuels. These compounds are known to poison catalysts at concentrations of sub-ppm levels in syngas. It is critical to remove and quantify these compounds to provide an efficient and cost-effective approach for Fischer-Tropsch synthesis. The analytical techniques in this study will focus on off-line and on-line gas measurements that were analyzed from a 20 kg/hr fluidized bed biomass gasifier with a unique gas cleaning system. Minor constituents of raw and clean biomass gasification syngas were analyzed on-line using a custom designed dual Gas Chromatography (GC) system before and after the cleaning stages. Trace concentrations of hydrogen sulfide, carbonyl sulfide, carbon disulfide, and ammonia were determined with a limit of quantification (LOQ) level of ppb with sulfur and nitrogen chemiluminescence detectors (SCD/NCD). Hydrogen cyanide concentrations were determined using Ion Chromatography with pulsed amperometric detection (PAD) using a silver working electrode. These samples will be captured in an impinger train using a basic aqueous solution and quantified off-line.

96. CHARACTERIZATION OF BIOMASS PRODUCER GAS GENERATION IN BIOMASS GASIFICATION

Yunye Shi, Eric Osgood, Tejasvi Sharma, Albert Ratner
University of Iowa

Biomass gasification is a thermo-chemical method which can convert biomass into combustible gasses including CO, CH₄, H₂. These gasses can be used in boilers, internal combustion engine, or turbine to produce electricity. The paper is focused on characterization of biomass producer gas generation through gasification process. The influential factors including material particle size, mixture of different materials, and material with different moisture content have been studied. A lab-scale gasification system is employed. Various biomasses have been gasified and tested for their gas evolution using a Micro GC. The results show the various factors' influence on producer gas generation in gasification process.

Environmental Science & Health Section Poster Presentations

97. THE EFFECTS OF *IN UTERO* EXPOSURE TO ATRAZINE ON THE HEMATOPOIETIC SYSTEM IN *MUS MUSCULUS*^{PPP}

Katie Smith, Debra Martin, and Rebecca Snyder
Saint Mary's University of Minnesota

Atrazine is a very common herbicide that is used in the United States and throughout the world. However, despite its agricultural benefits, Atrazine is not biodegradable when dissolved in water. This leads to the question of what kind of adverse effects atrazine may have on humans as well as animals when consumed. Many negative effects have already been identified when animals and people are exposed during development. In order to further investigate these effects, the hematopoietic system of mice (*Mus musculus*) that have been exposed to atrazine at varying concentrations *in utero* are observed. This was done by measuring the packed cell volume, red blood cell counts, erythropoietin levels, and weights of the pups during the first ten weeks after birth. The results of this experiment further describe the negative effects of ingesting atrazine, especially while pregnant. The mice that were exposed to atrazine exhibited an initially elevated packed cell volume that decreased to below that of the control mice at nine weeks. In addition to this the red blood cell (RBC) counts showed an increasing trend from four to eleven weeks as opposed in the 30 ppb group. The control and the 3 ppb groups, however, showed a decreasing trend. To further analyze these changes in RBC counts an erythropoietin ELISA was performed on the serum and selected tissues.

98. TOXICOLOGICAL IMPACTS OF ROAD-SALT CHLORIDES IN A URBAN AND RURAL AREA OF THE MISSISSIPPI WATERSHED

Eric Thomas Stone, Logan James Webb, and Adam Richard Hoffman
University of Dubuque

The City of Dubuque applies nearly 7,500 tons of road salt and nearly 50,000 gallons of liquid deicer annually. Several forks of Catfish Creek, a tributary of the Mississippi River running through Dubuque, have elevated levels of chloride throughout the year. In this study we examined characteristics regarding chloride distribution in a spectrum of urban and rural sites. Soil chloride concentrations were monitored for two full seasons to determine the seasonal variation in chloride levels. The EPA has

suggested limits of 230 mg/L for chronic aquatic life exposure and 860 mg/L for acute aquatic life exposure in surface water. The average chloride concentrations for extracted soil samples ranged from 2.0 mg/L to 140 mg/L, however multiple individual samples approached the suggested limits for chloride levels. Seasonal differences in soil extract chloride concentrations were significant. Toxicity tests using environmentally relevant chloride concentrations identified a decrease in seed emergence in *Brassica rapa*, a fast growing plant used in numerous toxicological tests. Toxicological 48-hour LC50 tests were performed to determine the toxicity of road-salt chlorides on *Lumbriculus variegatus*, an aquatic worm. The LC50 of chloride was determined to be 1,450 mg/L, which was well above the concentrations we noted in extracts from our soil samples. Although our soils showed an elevated amount of chloride in soils likely due to road-salts, only in a few instances were the concentrations at levels of concern.

Environmental Science & Health Section Oral Presentations

99. REPRODUCTION IN FEMALE *MUS MUSCULUS* EXPOSED TO ATRAZINE *IN UTERO*^{PPP}

Marissa Wollak, Jeanne M. Minnerath, and Debra J. Martin
Saint Mary's University of Minnesota

Atrazine is a selective herbicide used for weed control in agriculture and is known to accumulate in the soil and ground water. Studies have shown that Atrazine is found in 80% of drinking water sources sampled in the Midwestern United States. Research has shown there are health risks associated with Atrazine exposure, and because of this, the EPA has indicated that drinking water should contain no more than 3 ppb of this herbicide. Data indicates that mothers exposed to atrazine in their drinking water gave birth to children with low birth weights and abnormal fetal development. The purpose of the present study was to examine the effects of *in utero* exposure to atrazine on female reproduction using mice as the animal model. Thirty female mice that had been exposed to atrazine *in utero* (0, 3, 30 ppb atrazine) were impregnated by male mice, which had not been exposed to this herbicide. Sex hormone levels (testosterone and estradiol) in these female mice were measured before, during, and after pregnancy. Additionally, their litter sizes and the development of their pups were also evaluated. Results from this study will further our understanding of the effects of atrazine exposure on female reproduction.

100. EFFECTS OF *IN UTERO* EXPOSURE TO ATRAZINE ON IMMUNE CELL FUNCTION IN MICE^{BBB}

Catherine A. Gas and Jeanne M. Minnerath
Saint Mary's University of Minnes

Atrazine is one of the most widely used crop herbicides in the United States, and studies have shown that 80% of ground water samples taken within the United States contained traces of this herbicide. Multiple studies have examined the effects of atrazine on animal health and development. The purpose of the present study was to analyze the effects of atrazine on immune cell function in animals exposed to the herbicide *in utero*. To do this, pregnant female mice were fed drinking water containing atrazine (3 ppb or 30 ppb) during their pregnancies. Pups from these mothers were then immunized with the antigen ovalbumin (OVA), and antibody levels were assessed at various time points post-immunization. Additionally, splenocytes from these animals were stimulated with ConA, and IL-2 production was evaluated. Results indicated that female mice exposed to 30 ppb atrazine *in utero* exhibited significantly decreased levels of anti-OVA antibody titers compared to control mice. ConA-stimulated splenocytes from male and female mice exposed to 3 ppb atrazine *in utero* produced significantly decreased levels of IL-2 compared to control mice. Thus, *in utero* exposure to high concentrations of atrazine (30 ppb) appeared to negatively affect the B cell (humoral) immune response of female mice, and *in utero* exposure to low concentrations of atrazine (3 ppb) appeared to negatively impact the T cell (cell-mediated) immune responses of both genders of mice.

101. CHARACTERIZATION OF ATMOSPHERIC AEROSOLS IMPACTED BY THE IOWA CITY LANDFILL TIRE FIRE

Jared Downard and Elizabeth A. Stone
University of Iowa

The Iowa City landfill fire started on May 26th, 2012 and burned for 18 days affecting local ambient air quality. The landfill's drainage layer, made of approximately 1.3 million shredded tires, burned, emitting particles and gases to the atmosphere while leaving behind pyrolytic oil and ash. During the tire fire period, ambient fine particulate matter (PM_{2.5}) samples were collected at a nearby sampling site. Filter samples were analyzed for total organic and elemental (soot) carbon using thermo-optical techniques and for organic species using gas chromatography-mass spectrometry (GCMS). On days were the smoke plume impacted the site, levels of elemental carbon and polycyclic aromatic hydrocarbons (PAHs) were greatly enhanced. On June 2nd the 24-hour average concentration of PAHs peaked at 31.9 ng/m³, which was 75 times higher than observed background levels from May-June 2011. Of particular interest were the levels of benzo[a]pyrene, a highly carcinogenic compound, that reached a maximum concentration of 1.56 ng/m³ on this day. Ambient emissions from the Iowa City tire fire were also compared to other tire fire emissions data including an actual

soot sample and a simulated open air burning. Results showed similar PAHs were identified in all three studies, including chrysene, benzo[b]fluoranthene, benzo[k]fluoranthene and benzo[a]pyrene. Ongoing research includes analyzing samples collected during a laboratory experiment of a tire burning and using laboratory and field data to identify characteristic organic markers of tire fire emissions.

102. CHEMICAL COMPOSITION OF ATMOSPHERIC AEROSOLS IN IOWA CITY

Thilina Jayarathne and Elizabeth A. Stone
University of Iowa

Fine particulate matter (PM_{2.5} with aerodynamic diameter equal or less than 2.5 μm) plays important role in the environment due to its influence on public health, visibility, biogeochemical cycles, and earth's radiative balance. The composition and abundance of PM varies by its source region and exhibits a strong spatial and temporal variation. The objective of this study is to examine aerosol composition at two sites in Iowa City. Daily, 24-hour filter samples were collected from two sites in Iowa City from August 25 to November 10, 2011. Site 1 was located in a rather rural landscape and Site 2 was located in a more urban area. PM_{2.5} mass ranged from 3-26 μg/m³ during this time period, not exceeding the EPA National Ambient Air Quality Standard of 35 μg/m³. Carbonaceous aerosol was the dominant component of PM_{2.5}, contributing 40% of the PM_{2.5} mass. Sulfate and nitrate contributed to another 13% and 6% respectively. Elevated concentrations of sulfate were observed during late summer and elevated concentrations of nitrate were observed in fall; both species were correlated with temperature. Another 3% of total PM_{2.5} mass is contributed by calcium, indicating that re-suspended soil dust is a source of fine particles, especially during the month of October. A week-long episode with elevated sodium concentrations was observed at both sites in early October; its origin is currently under investigation. Higher elemental carbon and calcium concentrations were observed at Site 1, signifying a minor influence of local PM sources. Overall, the levels of other chemical components are not significantly different across the two sites suggesting their concentrations are primarily influenced by regional atmospheric processes.

103. SEASONAL AND SPATIAL VARIATIONS AND SOURCE APPORTIONMENT OF FINE PARTICULATE MATTER IN IOWA

Shuvashish Kundu and Elizabeth A. Stone
University of Iowa

Atmospheric aerosols control the earth's radiative balance by absorbing and scattering solar radiation. Extreme air pollution episodes with elevated particulate matter (PM) concentrations have increased human mortality and morbidity. Due to this climate and health effects, it is important to understand the chemical composition and sources of ambient PM. In this study, the

seasonal and spatial variations in the chemical composition and sources of fine particulate matter (PM_{2.5}) were investigated in Iowa. Chemically-speciated PM_{2.5} data from 2006-2010 were obtained from five United States Environmental Protection Agency (EPA) monitoring sites, including three urban locations: Cedar Rapids, Des Moines, Davenport and two background locations in Montgomery county and Van Buren county. The annual average concentrations of PM_{2.5} at Davenport (12-15 µg/m³) were higher than those at other sites (8-12 µg/m³). In Davenport, PM levels exceeded the primary National Ambient Air Quality Standard (NAAQS, 12 µg/m³) designed to protect sensitive populations, but were below the secondary standard (15 µg/m³) targeted at protecting public welfare. PM_{2.5} sources were studied with the positive matrix factorization (EPA PMF) source apportionment model. A group of 13 chemical species, common to all five study sites, were used as model inputs. Seven PM sources were identified and their relative contributions estimated: secondary sulfate (28-35%), secondary nitrate (22-27%), biomass burning (2-23%), motor vehicle emission (5-17%), non-tail pipe emission (0-5%), dust I (Ca-Si, 3-9%) and dust II (Al-Si, 3-7%). Across the five sites, the background sites had a higher influence of wind-blown dust, whereas anthropogenic and industrial influences were enhanced in urban sites, especially Davenport. The greatest motor vehicle contribution was observed in Des Moines. Seasonally, secondary sulfate and organic carbon peaked in the summer, whereas secondary nitrate peaked in the winter, consistent with prior studies in the Midwest.

104. OVIPOSITION SITE PREFERENCE IN MEDIA WITH AND WITHOUT CADMIUM IN DIFFERENT STRAINS OF *DROSOPHILA MELANOGASTER*

Melissa S. Herrmann¹, Andy Bixler², and Fred Schnee¹
Loras College¹ and Clarke University²

Oviposition site preference is a complex decision making process that is vital to reproductive success. The limited mobility of *Drosophila melanogaster* in larval form encourages females to oviposit at sites where their offspring have the greatest chance of survival. Therefore, the ability to detect and avoid noxious substrates, such as cadmium chloride (CdCl₂), should be crucial to the reproductive success of *Drosophila*. Several lab stocks (wild type, apterous, Bar, yellow, miniature-antennapodia) of *Drosophila melanogaster* and one natural strain originating from the Dubuque area were examined. The strains were given the choice of ovipositing on plates with 10mM CdCl₂ or plates lacking CdCl₂ to determine their response to this heavy metal. Strains showed significant variation ($p < .001$) both in terms of number of eggs laid and their avoidance of CdCl₂. The natural strain performed the best compared to all other strains in terms of both CdCl₂ avoidance and total number of eggs laid. Surprisingly, the wild type lab strain performed the worst in both categories even when compared to strains carrying a variety of different mutations. The wild type flies used in this experiment may have non-visible genetic variation affecting factors such as ovariole number or chemoreception. Overall, all strains of flies avoided cadmium chloride when depositing their eggs, suggesting that detection and avoidance of cadmium is a behavior of ecological im-

portance for females.

105. EFFECTS OF TRICLOSAN ON ZEBRAFISH METABOLISM

Shannon Schmidt, Patricia Braun, Mycaela Crouse, Annette Dean, Ellen Du Pre, and Nicole Palenske
Central College

Triclosan (TCS) has become one of the most prevalent biocides in use today. Triclosan is found in soaps, sanitizers, and detergents which run off and buildup in surface waters. Though the effects of triclosan are relatively unknown, research has tied it to metabolic issues primarily as a thyroid hormone disrupter. Using zebrafish as the model organism, this research was designed to determine what effects varying levels of exposure to triclosan had on newly hatched zebrafish. In the first stages of this project, freshly hatched zebrafish were exposed for 72 hours to levels of triclosan found in drinking water (20 ng/L TCS) and to environmental levels (200 ng/L TCS). Heart rates were determined after 72-hour exposure to these low levels. After this pre-exposure, zebrafish from each pre-exposure level were split into groups that were exposed to levels ranging from 50mg/L to 400mg/L TCS to determine the LC₅₀. Following 96-hour exposure to the higher concentrations, surviving fish had their heart rate counted in the same manner as the pre-exposure trial. An ANOVA test was used to determine significance of any alterations in heart rate between exposure and control groups. Pre-exposure to triclosan did significantly alter heart rate. Exposure to 20ng/L lowered heart rates, while exposure to 200ng/L raised heart rates compared to control heart rates. Pre-exposure did not have a significant effect on heart rate following the higher 96-hour exposure levels. An experimental LC₅₀ was determined that was much lower than reported LC₅₀s for zebrafish in other studies, possibly due to the younger age of the zebrafish used in this study. These results lead to the conclusion that more research should be done on the effects of triclosan on metabolism.

106. METOLACHLOR INHIBITS HUMAN ALVEOLAR CELL GROWTH

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

Metolachlor, a chloroacetanilide herbicide, controls pre- and post-emergent weeds and is used routinely in the Midwestern US. It has been increasingly detected in surface and ground water, and studies show it can contaminate the atmosphere via drift during application and has the potential to be inhaled. This pesticide has been shown to have many harmful effects in non-target cells including inhibition of cell growth, DNA damage, and altered protein activity. Previous work from our laboratory has found that growth of human liver cells (HepG2) and normal fibroblasts is inhibited after low-level metolachlor exposure. As mentioned, inhalation is a potential mode of exposure of this herbicide, however, very little is known about possible effects on lung cell health after pesticide exposure. The objective of this study is to evaluate the effects of metolachlor on cells that have

the potential to alter lung immune homeostasis: human alveolar monocytes and macrophages. A human alveolar cell line (THP-1) is used to assess the effects of metolachlor on cell growth. Since macrophages are differentiated forms of monocytes and behave differently from their undifferentiated counterparts, we will assess growth effects in both cell types. Results show that low-levels of metolachlor, as low as 50 ppb, significantly reduced cell growth ($p < .05$) of the undifferentiated monocytes relative to unexposed controls after 48 and 72 hours. Differentiated macrophages that produce important inflammatory mediators will also be evaluated for their growth effects after metolachlor exposure.

107. EFFECT OF DEFORESTATION ON MICROBIAL BIODIVERSITY WITHIN THE AMAZON RAINFOREST AND THE PRESENCE OF POTENTIAL NOVEL ACTINOMYCETES

Ashley Lutrick and Gary Coombs
Waldorf College

The Amazon Rainforest is possibly the largest reservoir of microbes in the world. Few studies have been conducted on soil bacteria in this area, and little is known regarding effects of deforestation at this level. The aims of this study were (a) to identify differences between microbial communities in pristine and slash and burn sites in the Amazon and (b) to identify potential novel Actinomycetes with antimicrobial efficacy against antibiotic resistant bacteria. Greater apparent biodiversity was seen in soil from pristine as compared to deforested areas. Also, one species was present in all soil samples from pristine forest but in no samples from a deforested area. This species possesses a non-secreted orange pigment that was not seen on any plates from slash and burn sites. A purple bacterium found only in pristine soil has been tentatively identified as *Janthinobacterium lividum*. *J. lividum* is often found on amphibian skin and can protect from fungal pathogens such as *Batrachochytrium dendrobatidis*, linked to population declines in amphibian species since 1999. An Actinomycete screen yielded 15 colonies which were tested for antimicrobial activity against *Klebsiella pneumoniae*, *Streptococcus pyogenes*, and methicillin resistant *Staphylococcus aureus* (MRSA). Three species produced clear zones with radii of 1.3 to 3 mm against a strain of MRSA isolated at Waldorf College. Two strains produced a killing zone against *S. pyogenes*, one with a 10 mm clear zone. No killing zones were observed against *K. pneumoniae*. The largest clear zones against MRSA and *S. pyogenes* were produced by an orange, water-soluble pigment producing Actinomycete. We are attempting to amplify 16S rDNA for identification of each Actinomycete.



Geology Section Poster Presentations

108. TEMPORAL VARIATIONS OF NITRATE IN MUNICIPAL WELL WATER IN CEDAR FALLS, IOWA

Alison R. Schell and Mohammad Z. Iqbal
University of Northern Iowa

Groundwater nitrate contamination has been a persistent concern in the drinking water of Cedar Falls, Iowa. Identifying the source of the relatively high nitrates in Cedar Falls Municipal Well 3 is the primary focus of this investigation. Although none of the municipal wells have exceeded the maximum contaminant level for nitrogen (45 ppm NO_3), the purpose of this project is to investigate the general drinking water quality in the area. To identify the source of the nitrate contamination, groundwater samples from four municipal wells, surface water samples from three sites on the Cedar River, and soil from twelve sites within one mile radius of the municipal wells were collected. A total of fifty water samples and sixty soil samples were collected over ten weeks from May through July 2012. Onsite parameters for water samples included dissolved oxygen (DO), pH, total dissolved solids (TDS), conductivity, and temperature. The water samples were tested for *E. coli* back at the laboratory. For soils, nitrate was extracted using 2 g of soil in 50 mL of distilled water that was shaken for four hours. Soil moisture and organic content were analyzed by the method called Loss on Ignition (LOI). Major ion chemistry of water was determined by ion chromatography. The results of this investigation show relatively higher nitrogen content in the soils around Well #3 (average nitrate [as NO_3] concentrations of .073 and .127 mg nitrate/g soil) and Well #11 (average nitrate [as NO_3] concentrations of .063 and .064 mg nitrate/g soil) that is derived through vertical infiltration of soil nitrate directly from the field through preferential pathways. The nitrate (as NO_3) level tested in Well #3 ranged from 34.4 ppm on July 18, 2012 to 39.5 ppm on July 5, 2012. Although nitrate coming from a faraway source through lateral migration within the aquifer cannot be ruled out at this point, predominant evidences point to local origin of nitrate. It is likely that inorganic nitrogen that accumulated in the soil over many years of fertilization in the past is now being slowly released into the soil through the process of nitrification because the area is now predominantly residential and there is no major source of nitrate in the soil. All other hydrologic parameters in the area are within the expected range of limits.

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Geology Section Oral Presentations

109. EXPLORATION FOR PLATINUM GROUP ELEMENT MINERALIZATION IN NORTHEAST IOWA

Raymond R. Anderson and Ryan J. Clark
Iowa Geological & Water Survey

Early this year (2013) the U.S. Geological Survey, working with the geological surveys of Iowa and Minnesota, initiated a program to explore rocks in the basement of northeast Iowa for platinum group elements and related mineralization (PGE). These rocks, the Northeast Iowa Plutonic Complex (NEIPC), are interpreted as a series of mafic plutons associated with the Middle Proterozoic Keweenaw Supergroup, emplaced during the formation of the Midcontinent Rift System about 1,100 ma. The exploration program was initiated due to the similarities between interpretations of the geology of the NEIPC and the Duluth Complex in northeastern Minnesota. Recent industry exploration of the Duluth Complex has led to the discovery of valuable PGE resources in those rocks, leading to the theory of similar mineralization in the Iowa rocks. The initial phase of the Iowa exploration involves analysis of limited drill data, including a Clayton County drill core that penetrates the rocks, and obtaining high resolution aerial gravity gradiometer, aeromagnetic, and aerial electro-magnetic data using low altitude helicopter and fixed-wing aircraft platforms over an area of Winneshiek County, Iowa, and adjacent areas of Fillmore and Houston counties in Minnesota. This paper will describe the geology of the NEIPC, present the early results of the exploration program, and outline future exploration plans.

110. SURFICIAL GEOLOGY OF THE HUDSON QUADRANGLE BLACK HAWK COUNTY, IOWA

Angela Petersen, Zach Lenth, and Chad Heinzl
University of Northern Iowa

Our goal for developing the surficial geologic map of the Hudson Quadrangle is to obtain geologic data that may be used for land use planning tools for Black Hawk County, the city of Hudson, Iowa, the Natural Resources Conservation Service (NRCS), and local landowners. The city of Hudson and the surrounding Cedar Falls/Waterloo metro area will have access to this data to improve their water resources management plans, wetland protection programs, aggregate resource management programs, and to help decrease pollution potential from Iowa's growing confined animal farming operations (CAFOs). These geologic data will further our current understanding and interpretations of the Iowa Erosion Surface. They will also provide baseline infor-

mation needed by engineers (city and county) within the Hudson Quad. to enhance flood preparedness, mitigation efforts, and their efforts toward sustainable development. UNI's EDMAP program will contribute to the on-going mapping programs of the Iowa Geological and Water Survey (IGWS), the NRCS, and the Black Hawk County Engineers Office. Because the surficial geologic map of Hudson Quadrangle is an on-going project at this time, the completed Waterloo South Quadrangle surficial geologic map was compared to current data and six geologic formations were identified within the Hudson Quadrangle (Qal, Qallt, Qalht, Qnw2, Qnw, and Qwa2).

111. DETERMINING THE PROVENANCE OF BUILDING MATERIALS FROM A PROTO-URBAN ELYMIAN SETTLEMENT AT THE BASE OF MONTE POLIZZO (WESTERN SICILY)

Anthony Boxleiter and Chad Heinzl
University of Northern Iowa

Monte Polizzo is an urban settlement left untouched since antiquity, inhabited from 900-476 BC. The intricacies of the anthropological past of the island of Sicily are muddled by the high frequency of human settlement and conflict between indigenous and foreign entities. The Bronze and Early Iron Age was a formative period in European History characterized by pervasive production and allocation of metal, linking societies together through networks of exchange across the continent. In the central Mediterranean, Sicily served as an integral highway between Greek culture and settlements to local cultures during this time period. Greek settlement into Selinute fostered one of the biggest urban entities in Sicily. Indigenous to Western Sicily, the Elymian settlement at Segesta would experience the exponential advance of Greek settlement into Sicily, producing secular friction between Selinute and Segesta. Assimilation into Greek culture can be accountable for what is little known about the identity and culture of the Elymians. It is presumable that the rise of Selinute isolated the Elymians from the sea. Ancient artisans of this culture would have undoubtedly preferred certain clay and earthen building materials, foreign or domestic, for the production of ceramics and building structures. The goal of this research will be to determine the provenance of the resources used to produce the building materials recovered from Monte Polizzo. The investigation will entail correlating textural and compositional properties of the materials with rock samples collected around Monte Polizzo. Data will be recorded by analyzing textural and mineralogical characteristics (petrographic observations) and chemical characterization (XRF analysis) of the indigenous rock samples and building materials. The results of this preliminary investigation could support the idea that contact between the proto-urban indigenous Monte Polizzo culture and neighboring cultures existed.

112. DETERMINING THE PROVENANCE OF BUILDING MATERIALS USED BY THE ELYMIAN CULTURE FROM THE SUMMIT OF MONTE POLIZZO, SICILY

John Chesley and Chad Heinzl
University of Northern Iowa

This interdisciplinary research presents the results of a geoarchaeological investigation on Monte Polizzo, Sicily. The project's focus is on the textural and mineralogical composition of the mountain's bedrock outcrops and building stone foundations. The objective of this research is to determine the provenance of anthropogenic materials from an Iron Age hilltop (900 BCE to 400 BCE) settlement known as Monte Polizzo, located in western Sicily, 6 km northwest of Salemi. Our focus is on a particular indigenous Sicilian group known as the Elymians, who occupied this particular area of Salemi between the 7th and 5th centuries BCE (Leighton, 2000). The ongoing geoarchaeological research suggests the Elymians may have adopted aspects of the Greek and Phoenician culture. Our research attempts to answer the question of where the Elymians acquired the resources used to build their stone foundations. An archaeometric approach is being taken by testing and correlating the chemical and physical properties between the building stones and the bedrock outcrops collected from known locations around Monte Polizzo. This approach is being executed with detailed hand sample, petrographic, and X-Diffraction (XRF) analysis of our samples. These lab analyses are still ongoing and may be used to lay down the groundwork for future projects. The results of this research could enhance our understanding of the Elymian culture and help contribute information into the ongoing research of the indigenous hilltop settlements of western Sicily.

Iowa Science Teaching Section Poster Presentations

113. APPLYING INQUIRY-BASED LEARNING TO ANATOMY & PHYSIOLOGY LABORATORIES

Traci Hoogland, Brittany De Ruyter, and Tony Jelsma
Dordt College

Anatomy and Physiology (A&P) labs are often designed to supplement course content by demonstrating the material covered in class. To cover large amounts of information, laboratory sessions are often cookbook labs in which students follow explicit directions to obtain predetermined outcomes. However, this approach neglects important experimental aspects of the laboratory and results in poor learning outcomes. By contrast, inquiry-based learning engages students in designing experiments to address questions and provides them with problem-solving skills

that are broadly applicable. We redesigned the first half of our 2-semester A&P lab sequence into 4 multi-week projects with increasing levels of freedom and expectations. The first project, of 4 weeks duration, had four stations each with a set of basic lab equipment. Groups of students were asked to design an experiment to answer a specific question. These labs introduced students to experimental design, learning how to use lab equipment, and how to use a lab notebook. In subsequent projects students were assigned readings, to which they were to respond before the lab period. In the lab they were given a broad question and lab time to brainstorm and design a specific research question. In later weeks they performed the experiment, did statistical analysis of the data, and reported results to the class. For the final project students could design any experiment dealing with the muscular and/or nervous system. To increase the number of replicates, the experiment chosen by popular vote was done by all groups. Overall, students were more prepared and engaged in these labs and spent more time on task, both in and outside the lab. Consequently, we have similarly redesigned the second semester A&P labs.

114. USING THE YEAST TWO-HYBRID (Y2H) SYSTEM AS A CLASS PROJECT TO TEACH UPPER LEVEL MOLECULAR BIOLOGY

Tony Jelsma and Robbin Eppinga
Dordt College

A challenge in teaching upper level biology labs is that experiments cannot normally be done in a 3-hour window. It can also be a challenge to motivate students using labs with predetermined outcomes. Third, more experienced students may be bored with a one size fits all laboratory. Finally, having everyone do the same thing simultaneously can be an inefficient use of resources. An unexpectedly large enrollment in our molecular biology lab course provided us with an opportunity to do a class project that addresses the above concerns. One of us has a collection of clones from an initial Y2H screen for proteins that interact with a myosin protein. Each student was assigned 3 clones in yeast, which they would characterize. This included plasmid isolation, transformation of *E. coli*, plasmid isolation and quantitation, restriction analysis, DNA sequencing, and BLAST analysis to identify and characterize their clones. Students could not begin their research until they demonstrated understanding of the Y2H system to the instructor. Students needed their lab notebook signed before each step in the process, which they could then do at any time the lab was open. Results were presented in a formal lab report. This approach allowed students to take ownership of their projects, troubleshoot problems, and learn techniques on their own. It also staggered the use of lab space and facilities, allowing more independent students to work on their own time, while less experienced students could use the regular time block with more supervision. Feedback from students was positive; students got a better feel for the nature of scientific research, they gained independence in the lab, and they were more interested in the results they obtained.

Iowa Science Teaching Section Oral Presentations

115. PUBLIC EDUCATION AND WILDLIFE MANAGEMENT

Ron DeArmond
Pella Wildlife Company

Pella Wildlife Company (PWC) is addressing concerns that hinder wildlife management programs based on science. The human element of wildlife management is becoming more important as it becomes clear that an understanding of the public and constituents often means the difference between the success or failure of wildlife management programs (Responsive Management, 2011). While the public has been increasingly drawn into the wildlife decision arena, typically, their level of wildlife knowledge is limited. Education of the public remains one of the greatest challenges for the future (63rd North American Wildlife and Natural Resources Conference, 1998). PWC has identified three key age groups and is developing wildlife education programs within those groups to bring awareness to the public based on accurate factual information. Those that attend programs learn a common sense approach to wildlife management that is relevant to them. Students, pre-k through university, are participating in PWC programs where STEM initiatives prepare students and get them involved in actual field work based on scientific methods used by government agencies to help monitor wildlife species. These programs feature live wildlife ambassadors because according to the National Science Teachers (NSTA) position statement "observation and experimentation with living organisms gives students special perspectives of life processes that are not provided by other modes of instruction. Study animals in the classroom enable students to develop skills of observation and comparison; a sense of stewardship; and an appreciation for the unity, interrelationships, and complexity of life." Other target age groups include adults age 25-55 and seniors 55+. Education programs created by PWC identify challenges faced by each age group and look at practical expectations for levels of understanding and participation from each group.

116. THE ROLE OF A RESIDENT SCIENTIST IN A HIGH SCHOOL SCIENCE CLASSROOM FROM THE PERSPECTIVES OF A GK-12 FELLOW AND A HIGH SCHOOL TEACHER

Eric Hall¹ and Thomas Garrison²
Des Moines Public Schools¹ and Iowa State University²

In this presentation, a Graduate STEM Fellows in K-12 Education Program (GK-12) Fellow and a high school teacher discuss their experiences as resident scientist-teacher partners in Symbi, Iowa's GK-12 Program. This NSF funded program is a joint collaboration between Iowa State University and the Des Moines Public School District, which is focused on educating and inspiring students to become interested in STEM subjects. The purpose of this program is for GK-12 Fellows to reinforce STEM principles to students by drawing on their research experiences as graduate students. GK-12 Fellows integrate into science classrooms as resident scientists or engineers by spending one full day in the classroom every week throughout the academic school year. The GK-12 Fellow has partnered with a chemistry teacher at Hoover High School in Des Moines. This was the first fellow-teacher pair in the Symbi Program to be in a high school chemistry classroom. This presentation provides examples of how the GK-12 Fellow has incorporated aspects of his research in bio-based polyurethane coatings into inquiry-based learning experiences and demonstrations for the students. Benefits of the program to the students, the teacher, and the GK-12 Fellow are discussed. Finally, recommendations and information about available resources are provided for teachers interested in incorporating aspects of biotechnology into their classrooms.



Organismal Biology Section Poster Presentations

117. THE ANALYSIS OF DIFFERING H₂O AMOUNTS ON THE EFFECTIVENESS OF AQUACOAT AND ZEBBA ON THE GERMINATION TIME OF POA PRATENSIS VAR. BARDUKE

Shaun R. Eberhart and Jennifer L. Stoffel
Upper Iowa University

Water-absorbent seed-coatings are demonstrated to increase the germination time of most turfgrass seeds. This study was performed to determine if differing the water amounts applied to *Poa pratensis* var. *Barduke* seeds coated in Zeba [starch-g-poly (2-propenamido-co-2-propenoic acid) potassium salt] or Aquacoat [ethylcellulose aqueous dispersion], both water-absorbent seed-coatings, had an effect on the germination of the turf grass seed. Twelve plots (6.0" x 11.6" x 5.5") were planted on February 11, 2013 with 30 seeds of each of the following seed variables: bare *Poa pratensis* var. *Barduke*, Zeba coated *Poa pratensis* var. *Barduke*, and Aquacoat coated *Poa pratensis* var. *Barduke*. The plots, each containing 980 cm³ of USGA spec sand, were placed into a greenhouse in a randomized design. Three plots of each seed variable were given either 1/8", 1/4", 5/8", or 1" of water per

week. These watering amounts were selected because 1" of water per week is beneficial for established turfgrass. All water applications were done with a pressurized backpack sprayer. Each seed, in each individual plot, was inspected daily on days 8 through 24 after planting to look for radicle emergence. After a seed had its radicle observed, the day it germinated was recorded and the seed was later discarded. A mean of rate of germination per day was then calculated for each seed variable and water application rate.

118. ROADSIDE-SURVEY OF NORTH AMERICAN BADGER EXCAVATIONS IN NORTHWESTERN IOWA

Rachel Held, Meg Williams, and Richard Lampe
Buena Vista University

The North American badger (*Taxidea taxus*) leaves records of its activity in the form of excavations. We wanted to know if there were differences in the sizes of such excavations that might suggest that individuals of different sizes had dug them. Three transects of 11 miles in length were surveyed during the spring and fall of 2012 in Buena Vista County, northwestern Iowa. Diggings found along mile-long segments of the transect were grouped together. The width of holes exceeding 50 cm in depth were compared across the transect length. Such holes would be representative of the size of the badger. Comparisons show that differences occur in closely spaced segments suggesting that different badgers had dug them.

119. SOYBEAN APHIDS INCREASE CALLOSE DEPOSITION NEAR SIEVE PLATES OF APHID-RESISTANT SOYBEAN PLANTS

Siau Ting Lau, Jessica Hohenstein, and Gustavo MacIntosh
Iowa State University

Callose, a β -1,3-glucan polysaccharide, is mainly deposited at phloem sieve plates and it is important in plant development and during plant response to the stress caused by sap-sucking insects. The soybean aphid (*Aphis glycines* Matsumura) is a herbivore insect that feeds on soybean phloem sap through its stylet. This feeding behavior causes many plant responses. Since other plants respond to aphid feeding by up-regulation of callose synthase and a stronger induction of callose deposition, we decided to investigate whether the same response was observed in soybean plants. Experiments were carried out to determine whether soybean aphid induces callose deposition in a soybean line carrying the Resistance to *Aphis glycines* (Rag1) gene. Soybean leaves were obtained after aphid infestation within a time course of 24 hours and 7 days. The leaves were then stained with aniline blue. Callose deposition in soybean leaves was then visualized under fluorescent microscope. A significant increase in callose deposition was observed one day after aphid infestation. A further analysis of the relationship between aphid infestation and callose deposition on susceptible plant will be carried out.

120. DETERMINING THE EFFICACY OF EMBARK AND PRIMO MAXX ON INHIBITING *POA ANNUA* VAR. *REPTANS* IN *AGROSTIS STOLONIFERA* WHILE MAINTAINING AESTHETIC QUALITY OF *AGROSTIS STOLONIFERA*

Jake Newman and Jennifer L. Stoffel
Upper Iowa University

Poa annua var. *reptans* is a turfgrass considered to be a weed in most turfgrass stands and causes problems with uniformity, aesthetics, and playing conditions on golf courses. Plant growth regulators (PGRs) have been effective at suppressing the production of seedheads in *Poa annua*. Some research has been performed to evaluate the effectiveness of using PGRs to control *Poa annua* infestation levels in *Agrostis stolonifera*. This study was performed to determine the efficacy of the PGRs Embark (N-[2,4-dimethyl-5-[[[(trifluoromethyl)sulfonyl]amino]phenyl]acetamide) and Primo Maxx (Trinexapac-ethyl) on inhibiting *Poa annua* in *Agrostis stolonifera* while maintaining aesthetic quality of *Agrostis stolonifera*. The study took place in a greenhouse with a photoperiod of 15.5 hours per day. All turfgrasses were established on December 11, 2012 in a mixture of 85% sand and 15% peat. Turfgrass heights were maintained throughout the experiment. The *Agrostis stolonifera* plots were seeded at a rate of 1.5 lbs per 1000 ft² in clear plastic containers with holes to allow for drainage (9.5" x 16" x 5" containers with 1/8" holes). The *Poa annua* plots were seeded at a rate of 3 lbs per 1000 ft² in 4" diameter round pots. The 16 plots of *Agrostis stolonifera* were randomized into four separate treatments each containing four plots of the following treatments: Embark, Primo Maxx, Embark and Primo Maxx, and a control. Two *Poa annua* plugs were added to every *Agrostis stolonifera* plot and then all plots received their respective treatment. The area of *Poa annua* in relationship to the *Agrostis stolonifera* was measured comparing treatments, and observations of the color of *Agrostis stolonifera* were recorded.

121. MODIFICATION OF SOYBEAN FATTY ACID LEVELS BY SOYBEAN APHIDS IS MAINLY A LOCAL RESPONSE

Khoi Nguyen, Gustavo MacIntosh, and Charles Kanobe
Iowa State University

The soybean aphid, *Aphis glycines*, is a phloem feeding pest that can reduce soybean yields by up to 40%. Aphids employ different mechanisms to bypass plant defenses and hijack their metabolism. Soybeans, in response to mechanical stress or insect attack, induce the oxylipin pathway, the biosynthetic route for jasmonic acid that is produced from a fatty acid precursor (18:3, linolenic acid). Jasmonic acid plays a variety of roles in soybean plant defense. Previous experiments showed a clear difference in fatty acids content between aphid-infested, physically wounded, and control plants. In the current work, we characterized whether these fatty acid changes were systemic or localized, by restricting aphid movement to a particular region. Results show a significant difference between several fatty acids (palmitic, linoleic, and linolenic) at the aphid-infested regions, as expected. However, the difference is not statistically significant farther

away from the infested region, either in the same leaf or on a different leaf. This suggests that the change in fatty acids is a local response or that the defense signal may not have reached other parts of the plant in the course of the experiment. Further experiments will clarify these results.

123. INVESTIGATIONS IN OPTIMAL FORAGING OF FOX SQUIRREL (*SCIURUS NIGER*) IN NORTHWESTERN IOWA

Grace Sullivan and Rick Lampe
Buena Vista University

Organisms have been shown to select foods based on maximum energetic value for minimal energetic costs. The current study examines the feeding behavior of fox squirrels (*Sciurus niger*) in Storm Lake, Iowa. The researcher hypothesized that a squirrel would initially spend more time feeding from a dish with easily accessible food and would move on to a dish with slightly less accessible food after reaching some (previously unknown) threshold for difficulty of retrieving food from the first dish. Three dishes containing glass beads mixed with varying densities of cat treats were placed on a feeding stand, and time spent feeding from each dish was recorded using a motion-activated video camera. In the current study, squirrels did not discriminate between dishes with higher densities of treats and dishes with lower densities of treats.



rganismal Biology Section Oral Presentations

124. CHEMICAL ANALYSIS OF METAPLEURAL TISSUE IN THE WESTERN THATCHING ANT, *FORMICA OBSCURIPES*^{BBB}

Aaron Henry and Moni Berg-Binder
Saint Mary's University of Minnes

Of the millions of species of insects, ants are the only class that have a metapleural gland, and nearly all ant species possess metapleural glands. Despite this, the metapleural gland purpose remains poorly understood. One widely accepted hypothesis suggests that metapleural secretions are used by ants for hygiene and antiseptic purposes. This is primarily due to the fact that many of the organic compounds found in metapleural secretions are known to have antibiotic (antifungal and/or antibacterial) prop-

erties. However, chemical analysis of metapleural secretions have only been examined in a limited number of ant species, and it is not understood whether the chemical composition of the metapleural gland secretion can change in response to the surrounding environmental bacteria community. In this study, the metapleural secretions of *Formica obscuripes*, a species not often studied, were examined. Different methods for secretion extraction from this species were employed including collection of secretion directly onto a glass slide, microcapillary extraction, and metapleural region excision. We found that direct collection and microcapillary extraction were not possible in this species. Excising of the metapleural tissue and washing it in mixed hexanes for organic compound extraction was necessary. GC-MS chromatograms of metapleural tissue extracts from *F. obscuripes* exposed to elevated bacteria compared with ants not exposed to elevated bacteria will be discussed. This research provides insight into the chemical exocrine response of the metapleural gland to increased levels of bacteria. It is also the first study to excise and explore the chemistry of *F. obscuripes* metapleural tissue.

125. MODELING MOISTURE CONTENT IN MAIZE KERNELS AS A LATENT VARIABLE FOR BIOCHEMICAL REACTION RATE

Kendra Meade¹, Mark Cooper², and William Beavis¹
Iowa State University¹, DuPont Pioneer²

Moisture content in maize kernels increases during grain fill until a maximum amount when the kernels approach physiological maturity. To date there has been little work on modeling the process of moisture content during kernel development. Herein, we propose to use the first derivative of a function used to model biomass accumulation in maize kernels. The first derivative is more commonly referred to as the rate of change function. Observations from two widely differing environments and a sample of hybrids were used to test the proposed model. By modeling moisture content as a derivative of biomass accumulation, moisture content can be interpreted as a latent variable for biochemical reaction rates.

126. EFFECTS OF WNT DISRUPTORS ON *NEMATOSTELLA VECTENSIS* DEVELOPMENT^{BBB} & ISF

John R. Greaves, Madelyne A. Besack, and Jacqueline W. Brittingham
Simpson College

The starlet sea anemone (*Nematostella vectensis*) 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 inhibitors alsterpaullone and arachidonylethanolamide (AEA) will disrupt normal cellular interactions during gastrulation, axis specifica-

tion, and regeneration events. Protocols for spawning were developed in our lab to obtain viable eggs that were synchronously fertilized, and then treated with alsterpaullone and AEA. We employed the use of cellular markers for cytoskeletal actin and performed morphometric analysis to characterize cellular organization in the embryos. We predict that alsterpaullone and AEA will inhibit the Wnt pathway causing a disruption in cellular architecture that will lead to defects in axis specification and morphogenesis. These studies are designed to further characterize embryonic development in this unique model organism and gain a better understanding of the role of the Wnt pathway in *Nematostella vectensis*.

127. VARIATION IN BAT COMMUNITIES IN EASTERN IOWA^{BBP}

Megan M. Johnson and Gerald L. Zuercher
University of Dubuque

There are nine species of bats (Chiroptera: Vespertilionidae) recorded for Iowa. This includes the federally endangered Indiana bat (*Myotis sodalis*), the state threatened evening bat (*Nycticeius humeralis*), and the state species of special concern northern long-eared bat (*Myotis septentrionalis*). Bats are important components of biodiversity that are often underrepresented in conservation and management plans due to lack of information on populations and habitat needs. North American bats are insectivores whose diets often include both human-disease vectors and damaging agricultural pests. Recently, bats have received significant attention due to concerns about the impacts of wind farms and White-Nose Syndrome. We sought to establish a profile of the bat community in eastern Iowa to serve as a reference against which future surveys can be evaluated. We sampled bat communities at five locations within Dubuque County, Iowa between June and early September. Sampling sites included a state park, three county parks, and a privately managed property. Overall, seven bat species were captured with little brown bats (*Myotis lucifugus*) being most common. Bat communities differed between sites and between sampling sessions in both species richness and total number of captures. Thus, we documented spatial and temporal variation in the eastern Iowa bat community. With the presence of White-Nose Syndrome confirmed at caves in eastern Iowa, our data provide a baseline against which impacts from the disease can be compared. We suggest continued surveys of bat communities in eastern Iowa.

128. MOVEMENT AND HABITAT USE OF PADDLEFISH IN MISSISSIPPI RIVER POOL 5A^{BBP}

Mark Ross and Josh Lallaman
Saint Mary's University of Minnesota

The American paddlefish (*Polyodon spathula*) is a primitive species of fish that once thrived throughout the major river systems of the Mid-west United States. Over-harvesting, introduction of invasive species, habitat destruction, and installation of dams

have resulted in a decline in populations over the past century. Because paddlefish are a migratory fish, which rely heavily on upriver spawning habitat, the presence of dams greatly hinders access to spawning areas and therefore negatively impacts the reproduction of this large river species. Previous studies have shown the presence of a small population of paddlefish in Poland Lake directly above Mississippi lock and dam 5A (Stiengraeber, 2005). Our objectives were to study seasonal habitat use and movements of paddlefish in Pool 5A. Nine paddlefish were captured, surgically implanted with radio transmitters, and tracked for the summer and fall of 2012. Movement was minimal throughout the summer until a period in the fall where fish could not be located. During the late fall, the paddlefish returned to the previous habitat occupied in the summer. Habitat use and home range of the paddlefish will be compared to previous study to investigate the effects of island construction and long-term habitat suitability in Pool 5A. This information will provide information on long-term viability of this population and what type of habitat management is needed to support paddlefish in the upper Mississippi River.

129. VIBRATIONAL SIGNALING MEDIATES INTER-MALE AGONISTIC INTERACTIONS IN THE COOK STRAIT GIANT WETA (*DEINACRIDA RUGOSA*)

Courtney L. Moore¹, Ashley P. Schmidt¹, Claire E. Bestul¹, Andrew C. Mason², Carrie L. Hall¹, and Daniel R. Howard¹
Augustana College¹, University of Toronto at Scarborough²

Vibrational communication is a common mode of information transfer in many arthropod groups, and has received increased study in the last decade as the ubiquity of its use has become increasingly apparent. The Cook Strait giant weta, *Deinacrida rugosa* (Insecta: Orthoptera: Anostostomatidae), is an endangered New Zealand insect found primarily on predator-free island reserves along the Cook Strait corridor. Belonging to a paraphyletic genera of eleven endemic species, all exhibit female-biased size dimorphism, nocturnal herbivory, and some form of a scramble mating system. The smaller adult males are known to move great distances each night while foraging and searching for mates, and recent studies have shown that differences between the sexes in regard to overall size and mobility are strongly influenced by sexual selection pressures. The communication system of the species has not been previously described, however. Using laser Doppler vibrometry we show that the Cook Strait giant weta utilize low frequency substrate-borne vibration for intraspecific communication in certain contexts, with males producing a duetting signal through dorsoventral tremulation. These signals are targeted to other males while in the presence of a female; solitary individuals, pairs of males in the absence of females, and pairs of females seldom produced vibration. Playback experiments confirm the contextual importance of this form of communication, with responses only elicited from males consorting with females. Our data show that the function of the vibrational signaling likely evolved as a mechanism for mediating inter-male contests for access to receptive females.

Physics, Atmospheric & Space Science Section Poster Presentations

130. PROBING THE SOLAR CORONA WITH RADIO ASTRONOMY

Jacob J. Buffo, Patrick D. Fischer, Jason E. Kooi, and Steven R. Spangler
University of Iowa

The solar corona is the outer layer of the Sun's atmosphere. It blends into an outward flow of gas through the solar system called the Solar Wind. The Solar Wind is of importance because it forms a medium through which solar disturbances can propagate and affect the Earth. There are many outstanding questions regarding the nature of the solar corona, most notably the process or processes responsible for heating it to a temperature of 1-2 million Kelvin, much higher than the 5800 K temperature of the solar photosphere. Understanding these processes, and the mechanisms responsible for generating the solar wind, require good knowledge of the plasma parameters of the corona. These parameters include the gas density, temperature, magnetic field strength, and level of turbulence in the corona, and how these parameters change with heliocentric distance. In this paper, we review the knowledge of the characteristics of the solar corona, and how research carried out at the University of Iowa is contributing to this knowledge. We will emphasize recent observations made by our group with the Very Large Array radio telescope in August 2011. Those observations probed the solar corona at heliocentric distances of less than 5 solar radii.

131. FORMATION AND CHARACTERIZATION OF ALKALI ORTHOBORATE CRYSTALS

Chloe Drapes¹, Evan Troendle¹, Mario Affatigato¹, Steve Feller¹, and Randall Youngman²
Coe College¹, Corning, Inc.²

Alkali orthoborate crystals have been produced as a first step to better understand the atomic structures of this borate system. Previous characterization of alkali orthoborate structures have only been done to a small extent with lithium and sodium orthoborates. Our aim is to expand the knowledge of orthoborates to cover all practical alkalis. Crystals have been characterized using techniques such as x-ray diffraction, scanning thermal calorimetry, Raman spectroscopy, as well as density derived by pycnometry. ¹¹B magic angle spinning and multiple quantum nuclear magnetic resonance were used specifically to try and identify the structural arrangement of the orthoborate composition.

Crystal production methods have varied in order to optimize quality and composition. Such methods include slow quenching in a nitrogen-dry environment and a solution method of crystal preparation. Precautions have been taken to minimize the effects of the hygroscopic nature of these heavy alkali content borates as well as CO₂ retention. The structures of the heavier alkali orthoborates have not been determined to date. This work is supported by the National Science Foundation under Grant Number DMR-0904615.

132. REMOTE SENSING MEASUREMENTS OF CORONAL MASS EJECTIONS

Patrick D. Fischer, Jacob J. Buffo, Jason E. Kooi, and Steven R. Spangler
University of Iowa

Disturbances on the Sun, involving huge releases of energy, can affect conditions on Earth. An important class of disturbance is a coronal mass ejection (CME), in which a large mass of the solar atmosphere, often in the form of a loop in the solar corona, becomes unstable and expands explosively out into interplanetary space. If these ejections collide with the Earth they can disturb the near-Earth space environment and upper atmosphere. We made observations with the Very Large Array radio telescope in the summer of 2012, designed to measure characteristics of a coronal mass ejection. The primary characteristic of interest is the form of the magnetic field in the CME. Our observations are also sensitive to the presence of turbulence in the ejecta. In addition to information on Coronal Mass Ejections, the observations yielded valuable data on the physical properties of the background solar corona when CMEs are absent. In this poster, we give a general overview of the CME phenomenon as well as describing the observations with the Very Large Array that we undertook in the summer of 2012.

133. MULTIPERIODIC PULSATING VARIABLES IN THE FIELD OF OPEN CLUSTER M23

Donald Lee-Brown and Jeffrey Wilkerson
Luther College

Luther College has an ongoing project to identify and classify stellar variability in the field of open cluster M23 in order to better understand long period variable behavior. We have identified 55 pulsating stars, 54 of them newly discovered, using the college's 9 years of photometric data for over 1600 stars in the field containing the cluster. The variable stars were identified through use of a statistical test comparing a given star's signal variance on consecutive nights to its variance over the entire data set. Period and periodicity analysis has allowed us to identify 17 stars that vary with a single period, 28 stars with multiple periods, and 9 stars with no evidence of regular periodicity. Analysis of period ratios within the multiperiodic group strongly suggests that excitation of multiple harmonic modes is the reason for the stars' multiperiodic behavior. We see that the monopерiodic stars generally have higher amplitudes than the multiperiodic

stars, and we identify the aperiodic stars to be redder than the multiperiodic stars, which are in turn redder than the monopero-
dic stars. These results suggest that variables with no apparent
periodicity may evolve into stars with several excited modes be-
fore finally varying with a single dominant mode.

134. CLASSIFYING ABRUPT SIGNAL CHANGES

Clara Olson and Jeffrey Wilkerson
Luther College

In the past 10 years, the Luther College astronomical observing
facilities have been used to acquire over half a million unfiltered
images of the field of open cluster M23. The 1600 stars in each
image provide a vast data set for searching for rare transient
events in stellar signal. The events could be either traditional
flares of the UV Ceti type or rarer events on stars of other clas-
ses. I will describe multiple techniques used for searching for
events and the process for removing background events caused
by non-astronomical sources. Samples of expected transient
events will be presented, along with upper limits on the frequen-
cy of flares for flares of varying durations and sizes in our images.

135. THE ROLE OF NONCLASSICAL TWO-PHOTON EF- FECTS IN INTERFERENCE OF TWO ATTENUATED LA- SER BEAMS^{1SF}

Mark Schneider
Grinnell College

Fourth order (two photon) interference effects have been ob-
served in many contexts utilizing sources of single or other Fock
state photons. This fact is often a surprise to those so impressed
by Dirac's words "each photon interferes only with itself. Inter-
ference between different photons never occurs"¹ that they take
them out of context. Similarly, those familiar with two-photon
interference effects often take statements such as that of Mandel
"it is impossible to detect the two emitted photons at two points
separated by an odd number of half fringes. Needless to say, this
conclusion has no classical analogy"² out of context to imply that
the nonclassical two-photon interference effects are not observa-
ble with light well described by a classical wave, such as from a
laser. Our work demonstrates that these surprising effects are
indeed observable with laser sources, subject to suitable correc-
tions to ensure that we are observing effects due to photons from
independent sources. We then propose extensions of this work
that may give interesting tests of the level of granularity of light
beams attenuated by different methods or see two-photon effects
that nevertheless appear second-order in anti-coincident correla-
tions. ¹P. A. M. Dirac. (1958). *Quantum Mechanics*. (4th ed., p.9). London:
Oxford University Press, London.; ²L. Mandel. (1983). *Phys. Rev. A*, 28, 929.
doi:10.1103/PhysRevA.28.929

136. MARSIS PROJECT

Adam Van Grootheest¹ and Dave Morgan²
Coe College¹, University of Iowa²

Mars Advanced Radar for Subsurface and Ionospheric Sounding
(MARSIS) is a radar system which consists of a light weight an-
tenna system, a receiver, and a digital processor attached to the
Mars Express Satellite launched in 2003. The radar system uses
low frequencies to scan the subsurface and Ionosphere of Mars.
The mode used to scan the subsurface was designed to look for
traces of water under the Martian surface. The mode of the radar
used to scan the Ionosphere is the Active Ionospheric sounding
mode. This mode scans by reflecting radio wave frequencies off
of the plasma in the Ionosphere. The system was designed to
probe the structure of the ionosphere and upper atmosphere of
Mars. In the summer of 2012, I worked with the Advanced Iono-
spheric Sounding part of the Project. I helped the team at the
University of Iowa translate the data they received into values
they could use. One application for their research is to see how
solar wind affects ionospheres. My presentation will explain and
illustrate the experiment, system, and recent findings of the
MARSIS project on a poster.

Physics, **A**tmospheric & **S**pace Science **S**ection Oral **P**resentations

137. NOVEL TECHNIQUES FOR GLASS CHARACTERIZA- TION AND MANUFACTURING: TIME OF FLIGHT MASS SPECTROMETRY AND AEROLEVITATION

Mario Affatigato
Coe College

We will present two techniques that have provided some new
capabilities in the characterization (Laser Ionization Time of
Flight Mass Spectrometry, LITOF-MS) and manufacturing
(aerolevitation) of exotic glass. The use of laser ionization com-
bined with time of flight mass spectrometry has yielded several
insights on the intermediate range structure of glass, and we have
moved towards quantification in the borate system. Aerolevita-
tion started out as an advanced manufacturing technique that
inhibits heterogeneous crystallization and can work at very high
temperatures, and thus provides the ability to turn some nearly
impossible compositions into glass. Lately, we have begun an
effort to incorporate the ability to detect and quantify crystalliza-
tion as we cool the levitated beads, creating a novel way to look
at high temperature nucleation and growth.

138. SPECTRAFIT: A NEW PROGRAM TO FIT ^{10}B NMR POWDER PATTERNS AUTOMATICALLY

Evan Troendle, Nathan Barnes, Victor Khristenko, Mario Affatigato, and Steve Feller
Coe College

We have developed a new program to fit ^{10}B NMR powder patterns. The program simulates the quadrupole interaction of ^{10}B (nuclear spin $I = 3$) with Gaussian distributions of the interaction parameters to fit solid amorphous and crystalline materials. A key aspect of this program is that it has been automated to find the best-fit parameters of the quadrupole coupling constant (C_Q) and the asymmetry parameter (η) as well as the widths (σ_{C_Q} and σ_η) of their distributions. Initially, this program has been used to find the best fit parameters of ^{10}B NMR spectra in amorphous B_2O_3 prepared at different cooling rates as well as polycrystalline lithium orthoborate, Li_3BO_3 . The technique is sensitive enough to clearly see differences in the three-coordinated boron quadrupole parameters. In addition, our program has been improved further to incorporate fitting two boron environments simultaneously with relative abundances of each boron site, as well as the construction of a spectra database for a much more efficient implementation. These advances give us the possibility of characterizing larger intermediate-range boron structures in amorphous materials. This work is supported by the National Science Foundation under grant number DMR-0904615.

139. POYNTING'S THEOREM IN ELECTROMAGNETIC THEORY VERSUS INTERACTION HAMILTONIAN IN QUANTUM MECHANICS

Kuo-Ho Yang
St. Ambrose University

In classical electromagnetic (EM) theory, Poynting's theorem is interpreted as a conservation law of EM field energy and matter's mechanical energy. Implicit in this interpretation is that $\mathbf{J}\cdot\mathbf{E}$ is the energy transfer mechanism between EM field energy and matter's energy. In quantum mechanics, the *unperturbed* Hamiltonian is interpreted as the matter's energy operator, and the interaction Hamiltonian drives the transitions between different eigenstates of the unperturbed Hamiltonian. The interaction Hamiltonian is expressed in terms of the EM potentials rather than fields. Two most notable differences between these two interactions are: (a) $\mathbf{J}\cdot\mathbf{E}$ is gauge-invariant whereas the interaction Hamiltonian is gauge-dependent and (b), in the case where there are EM potentials but no fields, $\mathbf{J}\cdot\mathbf{E}$ is identically zero whereas the interaction Hamiltonian and some of its matrix elements between two different unperturbed eigenstates may not vanish. For the electric dipole interaction, we show that only the interaction Hamiltonian of the electric dipole form $\mathbf{r}\cdot\mathbf{E}$ is consistent with Poynting's theorem. For the magnetic dipole interaction, the interaction Hamiltonian has the form of the magnetic dipole interacting with the magnetic field. In contrast, Poynting's theorem has the form of the magnetic dipole interacting with the time-derivative of the magnetic field.

140. GLASS FORMING LIMITS: A SIMPLE MODEL BASED ON SHORT-RANGE STRUCTURAL UNITS

Steve Feller
Coe College

In this talk I will discuss the glass forming limits found in five binary oxide glass systems and compare these limits to the short-range atomic-level structural units present. A generalizable model emerges. This model is then applied to ternary alkali borosilicates, like Pyrex, where certain additional patterns emerge. Complications to the simple model are introduced such as the effect of certain ring structures as well as the practical problem of carbon dioxide retention for glass prepared from carbonates. Physical properties and spectroscopic results are compared to some of the model predictions. I would like to thank the United States National Science Foundation for support under grant DMR 0906415.

Physiology & Health Science Section Poster Presentations

141. OVERCOMING TOLERANCE TO TRANSCUTANEOUS ELECTRICAL NERVE STIMULATION BY MODULATING FREQUENCY

Justin Brown¹, Emily Magers¹, Carol GT Vance², Barbra Raket², and Kathleen Sluka²
Simpson College¹, University of Iowa²

Transcutaneous Electrical Nerve Stimulation (TENS) is a non-invasive, electrical stimulus that is applied to the skin for pain relief. Clinically, TENS is used to treat acute and chronic pains including low back pain, neck pain, and osteoarthritis. Recent studies in healthy human subjects suggest that the usefulness of TENS is limited because tolerance develops over a period of 4-5 days. Importantly, animal research suggests that it may be possible to overcome this tolerance by administering a mixed rather than high frequency of TENS. It remains unknown whether this is true for humans. In this study we compared high frequency TENS to mixed frequency TENS to determine if mixed frequency TENS delays tolerance in human subjects. TENS was administered to 2 groups for 20 minutes every day for 5 consecutive days. One group received mixed frequency TENS and the other received high frequency TENS treatments. Our results showed that both mixed and high frequency TENS produce significant pain relief. The STAI, which is a widely accepted self-report of anxiety, strongly predicted the response of mixed frequency TENS on day 1. Those who scored higher on the STAI reported a lower response to TENS on the first day. In addition, initial statistical analysis suggests that those with a greater response on

day 1 may have experienced more tolerance over time. Our results also suggest that tolerance was delayed with mixed frequency TENS, but did not reproduce the previously reported finding that tolerances develops with repeated administration of high frequency TENS. Together these data suggest that TENS reduced pain and that neither an increase nor decrease in analgesia occurred with repeated administration.

142. FOOTBALL SHOE HEIGHT INFLUENCES PROPRICEPTION WITHOUT AFFECTING RANGE-OF-MOTION OR PERFORMANCE WHEN ATHLETES' ANKLES ARE TAPED AND SPATTED

Peyton P. Faganel, Ty C. Drake, Angela R. Dahl Miller, and David S. Senchina
Drake University

Ankle injuries are a common problem in football. Spatting (the application of additional tape over the shoe and sock) is one option for increasing ankle support for football players and is believed by some to prevent ankle sprains more so than taping alone. It is not known how the height of the football shoe (how much of the ankle it covers) influences the effects of spatting. Nine young adult males (21.6 ± 1.8 years, 180 ± 1.7 cm, 72.6 ± 2.4 kg) performed both a 60 yd sprint and a 25 yd cutting drill with their ankles taped and spatting, once in low-top and once in mid-top football shoes. Heart rate, performance time, and perceived foot comfort and stability were recorded for each drill. Ankle range-of-motion (ROM) was measured including dorsiflexion, plantarflexion, talar eversion, and talar inversion for both treatments plus two control conditions. Shoe height did not alter either heart rate or performance outcomes. Subjects perceived their feet as significantly more comfortable in the low-top shoe compared to mid-top shoe ($p = .015$). Though not significant, the average stability rating was higher for the mid-top shoe. Expectedly, ankle ROM decreased in a statistically significant manner (all $p \leq .06$) with increasing layers on the ankle: barefoot > taped only > taped + shod > taped + shod + spatting. However, there were no significant differences in ROM by shoe height when ankles were taped + shod or taped + shod + spatting. Even though the mid-top shoe covered the ankle malleolus whereas the low-top shoe did not, it appears that shoe height influences perception but not performance or ROM when ankles are taped and spatting.

143. SOMATOSENSORY PERCEPTION OF RUNNING SHOE MASS

Joel G. Greenya, Stephen J. Slade, Christopher L. Kliethermes, and David S. Senchina
Drake University

Running shoes are often marketed to consumers based on mass. Fifty young adult males participated across two separate experiments to determine how well they could perceive running shoe mass using hands versus feet. Foot perception was conducted identically in both experiments: Twenty-five subjects were blindly

fitted with five different test shoes one-at-a-time and asked to rank the heaviness of each individually using visual analogue scales (VAS) and then comparatively using verbal rankings. Hand perception was conducted differently in the two experiments. In Experiment A, subjects were allowed to heft all shoes simultaneously, whereas in Experiment B shoes were presented to subjects individually as they were in the foot portion. Foot Portion: There were no pass effects so the two data sets were combined. Residuals analysis indicated verbal accuracy in mass perception was 30%. One-way ANOVA with Tukey HSD indicated significant effects such that subjects were able to differentiate the heaviest and second-heaviest shoe from the lightest in both verbal and VAS. Verbal and VAS data correlated ($R^2 = 0.64$). Hand Portion: Verbal accuracy was 92% in Experiment A and 63% in Experiment B. ANOVA on verbal scores indicated that subjects could differentiate all shoe pairings in Experiment A and all but two in Experiment B. VAS data for Experiment B indicated only a third of pairings were significantly differentiated, and verbal and VAS data correlated ($R^2 = 0.67$). Altogether, these results strongly indicate the foot perceives mass poorly compared to the hand, and may suggest that consumers' perceptions of shoe mass may come more from handling shoes than wearing them.

144. EFFECTS OF BODY POSITION AND ARM ON BLOOD PRESSURE RECORDINGS IN MALES

Nick Haedt and Aaron Bunker
Morningside College

Controversy exists in the clinical setting whether blood pressure (BP) should be taken on only the right arm. It is also not known whether interarm differences exist in BP following sudden postural changes. This project examined whether BP differences exist between right and left arms when male subjects were in different static body positions and following postural changes. Young (18-23 years), healthy, male subjects ($n = 10$) were placed on a Head-Up-Tilt-Table and standard auscultation was used to obtain BPs at heart level. Respiratory rate was locked at 15-18 bpm for each subject. Bicep circumference for right arm (33 ± 0.8 cm) versus left arm (32.8 ± 0.8 cm) differed ($p = .03$), but arm length did not ($p < .05$). Neither body position nor arm affected systolic BP ($p < .05$). Diastolic BP was significantly higher in both arms when standing (left $p = .004$; right $p = .0009$) than when supine. When sitting left arm BP (85 ± 2.3 mmHg) differed significantly ($p = .03$) from right arm BP (80 ± 2.9 mmHg). BP (systolic and diastolic) following rapid changes in body position did not differ between arms ($p < .05$). Diastolic BP differences exist between the arms when sitting, and in either arm when standing compared to when supine. This information should be taken into consideration when obtaining BPs in the hospital setting.

145. DIAGNOSING AND EVALUATING THE PRESENCE OF MRSA ON A NORTHWEST IOWA COLLEGE CAMPUS

Andrea Hallberg and Elizabeth Heeg-Truesdell
Northwestern College

Staphylococcus aureus is a gram positive bacterium that is considered a normal part of a human's skin flora. Some strains of *S. aureus* have evolved to be antibiotic resistant, including those that are resistant to methicillin. These strains are known as methicillin-resistant *Staphylococcus aureus* (MRSA) and cause major health concerns. Two categories pertaining to how MRSA is acquired have been defined: Health care-associated MRSA (HA-MRSA) and Community-associated MRSA (CA-MRSA). Athletes in particular are at high risk for acquiring CA-MRSA as it is spread through skin-to-skin contact. Because of this risk factor we investigated the prevalence of MRSA in athletes versus non-athletes on the campus of Northwestern College, Orange City, Iowa. Using several differential tests and Kirby-Bauer antibiotic resistance tests, preliminary data suggests that 38% of the athletes tested were carriers of MRSA, while 15% of non-athletes were carriers. These numbers are significantly higher than previously published studies on other campuses (4% of wrestling team vs. 1.5% non-athlete). We have also worked on a diagnostic protocol to identify MRSA colonies using multiplex PCR which includes targeting the *MecA* gene and the 16S rRNA gene.

146. A DIFFERENT TAKE ON THE AMES TEST: TESTING NATURAL AND PHARMACEUTICAL CANCER THERAPIES ON *C. ELEGANS* WITH CANCER PHENOTYPES

Tyler Harm, Brooke Wehle, Miguel Munoz-Gomez, Andrew Schanbacher, and James Hampton
Buena Vista University

Caenorhabditis elegans has served as a model organism for the study of development, aging, and various other biological processes for over thirty years. Our research examines the changes in lifespan of adult worms exhibiting cancer-like phenotypes in response to varying concentrations of ginseng, docetaxel, and dichloroacetate. Ginseng is an ancient herb that has been thought to have cancer fighting abilities and has been recommended for patients undergoing chemotherapy. Docetaxel is a semi-synthetic derivative of taxol effective at the treatment of breast, prostate, and lung cancer. Dichloroacetate is a chemotherapeutic agent that is used to treat breast cancer. We have capitalized upon the short life cycle of this model organism to investigate the effects of these compounds on lifespan in wild-type and cancer-like mutants of *C. elegans*.

147. EFFECTS OF IVERMECTIN ON THE DEVELOPING HYPOTHALAMUS OF MAMMALS

Tyler Harm and Kristy McClellan
Buena Vista University

Ivermectin is a commonly used anti-parasitic drug. It has been used in both humans and most other mammals for years. However, it has just recently been discovered that it might be a GABA_A receptor agonist. Ivermectin is commonly given to pregnant animals and pregnant women. However, there has been little research done to see if the drug is actually safe for fetuses. For this study, we wanted to determine if Ivermectin could possi-

bly cause abnormal development in the hypothalamus of developing mammals. To do so, we treated three groups of pregnant mice. One group with a high dose of Ivermectin, another group with a low dose of Ivermectin, and another group with DMSO (controls). Each pregnant female was treated for a seven day period or until parturition occurred. After parturition, the pups were taken and their brains were removed for full analysis. Immunohistochemistry, Nissl staining, apoptosis assay, and pixel analysis was performed on slices of brain tissue from each pup. The immunohistochemistry labeled TH positive cells, caspase-3 positive cells, and GABA_A receptors. Two areas of interest examined were the arcuate nucleus and paraventricular nucleus. From the results, there was, on average, a 39.33% increase in the amount of TH positive cells in the paraventricular nucleus of the pups in the low dose group when compared to the controls. When treated with a low dose the area of the hypothalamus actually increased. There was also a 63.55% increase in the amount of caspase-3 positive cells in paraventricular nucleus when compared to the control paraventricular nucleus. This means that there was a larger amount of apoptotic cells in the hypothalamus of high dose pups. This pattern was also seen in the arcuate nucleus with an increase of 59.61%. From these findings, it is evident that Ivermectin, when given in at appropriate dose, has some kind of trophic effect on certain cells types of hypothalamus. Whether that effect is direct or indirect is still a question to be answered. It is also clear that if given at too high of a dose, Ivermectin can have deleterious effects.

148. THE ANTIBODY RESPONSE OF *MUS MUSCULUS* WHEN VACCINATED IN THE PRESENCE OF ACUTE ENVIRONMENTAL STRESSORS^{BBB}

Jacinta Jude and Randy Krainock
Saint Mary's University of Minnesota

Vaccinations stimulate B-lymphocytes to produce antibodies that protect the body against future exposure to a disease. Stressors cause the body to secrete hormones that act to maintain homeostasis. The increased secretion of the stress hormones norepinephrine and cortisol cause a decrease in the lymphoproliferative response. Through this mechanism, stress at the time of vaccination may reduce the effectiveness of the vaccine to stimulate the production of protective antibodies. Mice were exposed to 4 °C, 40 °C, or stressful noise for 10 minutes prior to vaccination with OVA. Serum was collected and antibody titers were determined by ELISA at 0, 3, 4, 5, 6 and 7.5 weeks post-vaccination. Data will be analyzed by ANOVA and results presented.

149. THE EFFECTS OF TOY ENRICHMENT VERSUS EXERCISE ENRICHMENT ON NON-SPATIAL WORKING MEMORY IN FEMALE *MUS MUSCULUS*^{BBB}

Megan Kelchen, Kaitlyn Baldrige, Anna Lauterbach, and Samantha Larimer Bousquet
Wartburg College

Environmental enrichment and its effect on learning and

memory has been an area of extensive research in recent years. Previous research has shown exercise enrichment significantly improved spatial memory in all age groups, while toy enrichment and complex enrichment improved spatial memory in specific age groups only (Harburger et al., 2007). However, little research has tested the effects of exercise and complex enrichment on non-spatial memory. This project is currently investigating the effects of different types of enrichment on non-spatial learning and memory in mice. Three different types of enrichment are being tested: non-enriched (control) group, an exercise (wheel) enriched group, and a toy (novel objects introduced every week) enriched group. Testing is being done using an object recognition test, which examines non-spatial learning and memory through the introduction of novel and familiar objects. These tests will be administered before the mice are placed in the enriched environment (baseline), as well as one month (midpoint) and two months (final) after being placed in the new environment. It is hypothesized that exercise enrichment and toy enrichment affect non-spatial memory in mice to different extents. It is predicted that exercise enriched mice would have the most improvement from the original baseline test in comparison to mice in toy enriched and non-enriched conditions.

150. ELECTROMYOGRAPHICAL ANALYSIS OF LOWER BODY MUSCLES DURING THE BACK SQUAT WHEN ANKLES ARE BRACED OR TAPED

Travis J. Merritt and David S. Senchina
Drake University

Athletes have multiple options for preventing or recovery from ankle injury during sport including bracing and taping. Taken together, previous studies suggest that ankle restriction appliances are generally effective at reducing range-of-motion (ROM) without negatively effecting performance, and with various effects on athletes' perceptions of foot comfort, stability, and other somatic measures. It is much less clear if or how such appliances also affect other body regions. The purpose of this investigation was to determine the effects of several different types of ankle braces as well as ankle taping on muscle activity of the lower body during a single-planar exercise, the back squat. Twenty-four young adult males (twelve football players, twelve non-football athletes) performed six sets of three back squats at 50% 1RM including sets in traditional semirigid lace braces, figure-8 braces, ASO braces, and control conditions (shoes alone). Electromyography (EMG) signals were collected from the quadriceps, hamstrings, tibialis anterior, and triceps surae during the lowering, holding, and rising phases of the squat. All subjects were asked to give ratings of comfort, exertion, and stability following each set. Goniometry was performed to determine the effects of each ankle appliance on ROM. Preliminary EMG analyses suggested that mean muscle activity across all muscles was lowest when subjects were wearing the ASO brace and highest during control conditions. ROM results suggested that the appliances were similarly efficacious in reducing dorsiflexion, eversion, and inversion, but differed in their effects on plantarflexion. Football players had significantly more eversion/inversion than non-football players. Subjects expectedly rated exertion as higher at the end of the

protocol but did not differentiate exertion between appliances. There were no significant differences in perception of stability or comfort across appliances, but football players were significantly more comfortable in ankle appliances. These results indicate there is a complex relationship between appliance type and muscle electrical activity, ROM, and somatic perception.

151. TWO EXPERIMENTS SUGGESTING BENZOPHENANTHRIDINE ALKALOIDS, THE CLASSICALLY-RECOGNIZED BIOACTIVE MOLECULES FROM BLOODROOT, MAY NOT FULLY EXPLAIN OBSERVED IMMUNOMODULATORY PROPERTIES OF BLOODROOT EXTRACTS^{ISF}

David S. Senchina¹, Marc G. Busch¹, Nisarg B. Shah¹, Colin T. Shearn², Taylor M. Noble³, Justus E. Hallam³, Marian L. Kohut³, Jennifer R. Robinson³, M. Ann D. N. Perera³
Drake University¹, University of Colorado², Iowa State University³

The springtime plant bloodroot (*Sanguinaria canadensis*) is common in Iowa and rich in quaternary benzophenanthridine alkaloids, which are purported to explain its in vitro anticarcinogenic and immunomodulatory properties. Two experiments were conducted to better understand the effects of these molecules on various cells. In the first experiment, the effects of various doses of berberine, chelerythrine, and sanguinarine on proliferation was determined using four immortalized cell lines: Jurkat (T-cell), K562 (undifferentiated granulocyte), Ramos (B-cell), and U937 (monocyte). Cell lines exhibited various sensitivities to the three compounds, but only sanguinarine consistently suppressed proliferation across cell lines and only at levels much higher than typically found in whole-tissue bloodroot extracts. In the second experiment, wild bloodroot was harvested every weekend for a 6-week period in spring 2009 and ethanol extracts were produced from the rhizomes per traditional lay herbalist techniques. Alkaloid content was determined using LC/MS. Human peripheral blood mononuclear cells were challenged in vitro with the extracts or solvent vehicle controls and assayed for cytokine production (the interleukins IL-1 β , IL-2, IL-4, IL-6, IL-8, IL-10 and tumor necrosis factor [TNF]) via ELISA and cell proliferation via a formazine salt assay. Seven alkaloids were detected, six which could be quantified (chelerythrine, chelilutine, chelirubine, sanguilutine, sanguirubine, and sanguinarine) and one detected in trace amounts (protopine). There was no vernal variation in alkaloid content. Sanguinarine was the most abundant alkaloid. Extracts demonstrated immunosuppressive effects on production of IL-2 and IL-8 and cell proliferation, but had no effect on other cytokines. Alkaloid content never correlated with immune outcomes. Taken altogether, these two studies suggest that while sanguinarine may explain the bulk of immunomodulatory activity ascribed to the alkaloid fraction of bloodroot, classically-recognized alkaloids may not fully explain observed immunomodulatory properties of bloodroot extracts.

152. THE EFFECTS OF CHOCOLATE ON EXERCISE BENEFITS IN RATS

Daniel Van Kalsbeek, Garrett Sterk, and Sara Sybesma Tolsma
Northwestern College

A number of studies indicate that (-)-epicatechin, a component of cocoa, enhances the exercise benefits of skeletal muscle by increasing capillary density and mitochondrial function in mouse skeletal muscles. We wondered if dark chocolate (90% cacao), rather than the isolated compound (-)-epicatechin, might have similar effects on skeletal muscles in rats. We studied four groups of rats. One group ate dark chocolate, the second group underwent a 30-day swimming regimen, the third group ate dark chocolate and swam and the fourth group, the control, was untreated. After the treatment period, we excised hind and foreleg skeletal muscles from sacrificed rats. We used a cryostat to transversely section the excised skeletal muscles which were fixed and stained to determine capillary density and mitochondrial abundance. We performed Western blot analysis on skeletal muscle tissue to measure the levels of proteins involved in angiogenesis regulation, the growth of new blood vessels from existing ones, and in mitochondrial function. We will be presenting preliminary data from these experiments.

153. FOOT TEMPERATURE DURING TREADMILL RUNNING IN COTTON VS. SYNTHETIC ATHLETIC SOCKS^{BBB}

Nickolas L. Van Roekel, Erin M. Poss, and David S. Senchina
Drake University

One previous study suggested that perceived foot heat and comfort may not coincide with actual foot temperature during brief bouts of treadmill running and that different shoe and sock materials may variously impact foot temperature. This experiment sought to determine if there were significant differences in foot temperature produced by cotton versus synthetic (olefin-based) athletic socks during longer runs (a method more closely resembles recreational runs) and if subjects were able to perceive those differences in terms of either comfort or temperature. Twelve adult males (22.4 ± 1.8 years, 180.6 ± 1.2 cm, 70.1 ± 1.6 kg) participated on two separate occasions a week apart. Subjects ran for 30 minutes with two temperature probes attached to the lateral dorsal aspect of the right foot in the same location: one directly on the skin and the other on the sock. All subjects wore the same shoe model. Foot temperature, heart rate, heat perception, and comfort perception were recorded. Perception was measured by using 10 cm visual analogue scales. Each subject ran once in the cotton-based sock and once in the olefin-based sock. Subjects did not perceive any significant difference in comfort or temperature between cotton and synthetic socks, and heart rate did not vary significantly between the two trials. The olefin-based sock was associated with significantly lower absolute temperatures at the sock thermometer site but not the skin thermometer site; however, changes in temperature from one time point to the next were the same between the two socks for either thermometer site. The results cannot conclusively state that one sock has advantage over the other, but they suggest olefin-based

socks may dissipate heat better than cotton-based socks under certain conditions.

154. CARDIOVASCULAR RESPONSES TO A COLD WATER STIMULUS: A COMPARISON BETWEEN SWIMMERS AND NON-SWIMMERS^{BBB}

Jordan Michael Wineland, David Charles King, and Aaron Kristopher Bunker
Morningside College

Studies exist examining the physical response to a cold-water stimulus, but few examine the effects of the dive response after people have been conditioned to a cold-water stimulus. The dive response is the body's innate ability to cope to cold-water exposure. This project examined whether the dive response was different in swimmers versus non-swimmer athletes. Blood pressure, heart rate, and blood volume of the lower extremities were compared between the two subject groups. Young (18-23 years), healthy men and women from the appropriate experimental groups were placed through a series of three experimental situations. Situation one acted as a control; two acted as the simulation of the dive response; three examined breath holding as a possible primary stimulus for the observed vital responses. Water was kept at 15 °C and blood pressure was taken before and after each part. No significant difference was seen in the systolic or diastolic readings between swimmers and non-swimmers (systolic, $p = .63$; diastolic, $p = .77$). Leg volume change was also not significant between the study groups ($p = .22$). The data suggest that people conditioned to a cold-water stimulus do not have a significant change in vital signs compared to unconditioned people. This study could suggest that the dive response is an innate human survival response that cannot be significantly changed by conditioning.

155. MOLECULAR MODEL OF SALIVA AND DENTAL PELLICLE: EXAMINING INTERACTIONS RESPONSIBLE FOR PLAQUE FORMATION^{BBB}

Jordan Michael Wineland, Andy Thomas
Morningside College

Significant interest in the oral health field lies within the chemical interactions of ionic molecules and bacterial adhesions taking place in the dental pellicle and saliva. The dental pellicle, the layer between the enamel of the tooth and saliva, is composed of salivary proteins, carbohydrates, and lipids. Proteomics studies have been done on the composition of the pellicle and saliva, but few show the interactions between the biomolecules within these two areas. This project was done to not only show the interactions but to allow for a visual representation of the two areas. This construction was done by computationally modeling the various components in saliva and examining their interactions with the protective pellicle layer. *Streptococcus mutans*, one of the primary bacterial initial invaders responsible for plaque formation, was examined in order to model the interaction between its surface glycoproteins and the various pellicle components.

This study could help provide insight into plaque formation and allow for a way to prevent the initial bacterial colonization of teeth.

156. BIOTHERAPEUTICS USAGE BY IOWA PHARMACISTS: A SURVEY

Sierra R. Wooley, Masoud S. Yousif, Rhonda Cross Beemer, and Pramod B. Mahajan
Drake University

Biotherapeutic drugs, drugs that are produced using biological means such as recombinant DNA technology, are becoming extremely important in the treatment of a number of disorders such as cancer, immunological, and certain gastrointestinal diseases. Paucity of basic information in health care professionals regarding specific biotherapeutics is an important challenge associated with successful applications of biotherapeutics. The objective of our study was to evaluate the knowledge about and usage of biotherapeutics by pharmacists in Iowa. Sixty-eight pharmacists were surveyed (57% females and 43% percent males ranging in age from 26-72 with various pharmacy degrees from eight different institutions) and completed the survey. Approximately 30% of participants surveyed stated they have worked with some form of biotherapeutic drug. Of these, 79% have worked with up to 5 different biotherapeutics and 16% worked with 5 to 10 different biotherapeutics. Nearly 12% participants stated they were not sure if the drug they worked with was a biotherapeutic. Finally, 48% of the pharmacists surveyed stated they were not well informed regarding the usage of biotherapeutic drugs. Our preliminary results indicate a need to expand this research on a national level with possible implications for developing continuing education programs for pharmacists and other health care professionals.

Physiology & Health Science Section Oral Presentations

157. EVENING PRIMROSE (*OENOTHERA BIENNIS*) SEED EXTRACT, INCREASES THE FORCE AND FREQUENCY OF CONTRACTIONS IN ISOLATED STRIPS OF MOUSE UTERINE TISSUE^{BBB}

Chelsea Lyle and Teresa DeGolier
Bethel University

The effect of Evening Primrose (*Oenothera biennis*) seed extract on mouse uterine horns in a tissue bath was investigated at several different concentrations: 10, 20, 30, and 40 mg/15 mL bath. Evening Primrose seed extract (EP) increased the force of sponta-

neous motility ($p = .0736$) and the rate of spontaneous motility, though the latter was not statistically significant. No concentration-dependency was observed on the force or rate trends for EP. These contractile forces were slightly greater than that evoked from the endogenous neurotransmitter acetylcholine (10^{-5} M). Two receptor antagonists were also used to investigate the potential mechanism through which EP induces smooth muscle contractions. Independent of dose, atropine, a cholinergic muscarinic blocker, caused an approximate 50% reduction in the force of spontaneous contractions ($p = .012$) and a 25% reduction in the rate of spontaneous motility ($p = .024$). Nifedipine, a calcium channel blocker, completely inhibited the effect of EP on the tissues at both 20 and 30 mg concentrations ($p = .0246$), and also inhibited a 40 mg concentration, but not significantly ($p = .2276$). These results may imply that the contractile mechanism of EP on uterine tissue is at least partly mediated through cholinergic receptors and calcium channels. While most documented research on reproductive physiology presents the role of EP on cervical ripening, this project uniquely reports the effects on uterine contractility.

158. THE PHYSIOLOGICAL EFFECTS OF *CRESCENTIA CUJETE* (CALABASH TREE) FRUIT ON UTERINE MUSCLE CONTRACTIONS OF *MUS MUSCULUS* IN VITRO^{BBB}

Kristin Bell and Teresa DeGolier
Bethel University

Herbal supplements have been used as an alternative to synthetic hormones for inducing labor in pregnant women. The effectiveness of the herbal supplements, their mechanism of action, and their potential side effects to both the mother and child, however, have not been well documented. The purpose of this study was to determine the effectiveness of a minimally researched tropical fruit, *Crescentia cujete* (Calabash Tree) on the contractile forces observed on uterine tissue of *Mus musculus* in vitro. Twenty-four excised uterine horns from 12 female mice were placed in a smooth muscle bath containing De Jalons solution. Following a positive contractile response to ACh 10^{-5} M, the calabash extract was delivered to the tissues. Frequency, amplitude, and change in baseline of the tissue contractile responses were measured following (a) the administration of 100 μ L and 200 μ L blended calabash pulp or (b) 5 mg/mL, 25 mg/mL, and 40 mg/mL of calabash seed extract. Increases in frequency as well as overall increases in contractile tension were observed; these changes were not concentration dependent. Greater magnitude of responses were recorded following the calabash seed application. These results are consistent with the records of Mayan healers, who have documented using calabash pulp to encourage labor and calabash seeds to promote abortion. Further research using receptor antagonism will help to determine the mechanism of calabash action on uterine tissue receptors.

159. MYOSIN HEAVY CHAIN GENE EXPRESSION DUE TO AN INCREASED CREATINE-MONOHYDRATE LEVEL AMONGST EXERCISED AND NON-EXERCISED MICE (*MUS MUSCULUS*)

Megan Johnson, Kelsey Hunstad, and Debra Martin
Saint Mary's University of Minnesota

Creatine is naturally formed within humans, as well as all vertebrates, and has gained popularity as a muscle enhancement supplement. Preliminary research has demonstrated that gene expression and skeletal muscle gain may be influenced by creatine monohydrate supplementation when combined with exercise. It has been hypothesized that the myosin heavy chain genes, which are vital for proper muscle functioning, have altered expression within population of mice that are either exercised or non-exercised with the added supplement of creatine monohydrate compared to their correlating control groups. The purpose of this experiment was to determine if creatine monohydrate enhances the expression of different isoforms of the myosin heavy chain by analysis of muscle myosin mRNAs by RT-PCR.

160. EFFECTS OF BODY POSITION AND ARM ON BLOOD PRESSURE RECORDINGS IN FEMALES^{PPP}

Kaitlin Gerber, Blake Schany, and Aaron Bunker
Morningside College

This project examined whether blood pressure (BP) differences exist between right and left arms when female subjects were in different static body positions and whether measured BP following rapid postural changes is similar between arms. Young (18-23 years), healthy, female subjects (n = 8) were placed on a Head-Up-Tilt-Table and standard auscultation was used to obtain BPs at heart level. Respiratory rate was locked at 16-22 bpm for each subject. Bicep circumference differed (p = .06) and was slightly higher for right arm (27.6 ± 1.6 cm) versus left arm (26.8 ± 1.5 cm), and arm length did not differ significantly between the arms (p < .05). There was significant difference found in systolic BP in the left arm when comparing standing values to sitting values (p = .01). Diastolic BP was significantly higher in both arms when standing (left p = .03; right p = .002) and tended to be higher when sitting (left p = .05; right p = .03) than when supine. Diastolic BP differences exist in either arm when standing or sitting compared to when supine. This information should be taken into consideration when obtaining blood pressure readings in the hospital setting.

161. TARGETING GENE DELIVERY BY LENTIVIRAL DISPLAY OF STEM CELL FACTOR

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It would be very beneficial if a gene therapy approach were developed to cure bloodborne genetic diseases without the need to transfer the therapeutic gene to Hematopoietic Stem Cells (HSCs) ex vivo. A retroviral vector that selectively infects HSCs would have the potential to target HSCs mobilized from the bone marrow into circulation. The measles virus hemagglutinin (H) and Fusion (F) glycoproteins (gp) can be modified to retarget lentiviral vectors to specific cells¹. Modifications include the deletion of their cytoplasmic tails and addition of a ligand-specific for a cellular receptor - to the C-terminus of H gp. The c-kit receptor is a marker for HSC and can be potentially targeted by its ligand, Stem cell factor (SCF). The mouse SCF was engineered as an additional C-terminal domain of the measles virus (MV) H gp (H-mSCF). Lentiviral vectors pseudotyped with MV F and H-mSCF glycoproteins demonstrated very low levels of infection of certain target cells. Future studies will focus on increasing viral titers, optimizing H-mSCF constructs, and demonstrating selective infection of HSCs.

162. DISCOVERY OF CANDIDATE GENES CAUSING GLAUCOMA THROUGH STUDIES OF PROTEIN-PROTEIN INTERACTION THROUGH THE YEAST TWO-HYBRID ASSAY

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Glaucoma, one of the leading causes of blindness worldwide, is caused by damage to the optic nerve. The most common risk factor associated with glaucoma is increased ocular pressure (IOP). Exfoliation Syndrome (XFS) is a human disease in which exfoliative material accumulates in the anterior chamber of the eye, blocking ducts that drain aqueous humor. An increase in intraocular pressure arises that often leads to glaucoma. A strain of mice, B6-Lystrbg-J, has eye symptoms similar to those found in humans with XFS and are being studied to investigate the molecular mechanism of glaucoma. The ocular defects in these mice are caused by a mutation in the *LYST* gene. *LYST* is a large cytoplasmic protein involved in the biogenesis of lysosome-related organelles. Previous studies have shown that *LYST* interacts with Casein Kinase II via its WD40 domain through a yeast two-hybrid screen, suggesting that this interact functions in signal transduction and vesicle trafficking. Mice with symptoms of XFS have a mutation in the WD40 domain of *LYST*. We tested whether the mutation in the WD40 domain of *LYST* prevented its interaction with Casein Kinase II. In GST pull down assays, we have previously demonstrated the WT WD40 domain of *LYST* interacts with Casein Kinase II, while the Mut WD40 domain of *LYST* did not. To confirm these results, a yeast two-

hybrid assay will be performed. The first step in this experiment is to clone the cDNA sequences of the WT or Mut WD40 domain of LYST and Casein Kinase II into appropriate yeast vectors. Once these plasmids are made, a yeast two-hybrid assay will be performed to test if the WT WD40 and/or the Mut WD40 domain of LYST are interacting with Casein Kinase II. Further evidence of possible protein-protein interactions with LYST will help us better understand the molecular mechanism of exfoliation syndrome and potentially glaucoma which may lead to possible preventions or treatments of these diseases.

163. A COMPARISON OF THE EFFECT OF TRADITIONAL CARDIOVASCULAR EXERCISE AND VIDEO GAME EXERCISE ON VO_{2MAX} , RESTING RER, RESTING HEART RATE, AND MUSCLE STRENGTH

Kaveria A. Allen and Melissa A. DeMotta
Clarke University

Creators of the Nintendo Wii developed a game that motivates its users to become more fit and active in their daily lives. The Wii Fit strategically provides ways participants can increase their heart rate, strength, endurance, and metabolic rate by mimicking the actions of traditional exercises. Looking specifically at cardiovascular exercises the Wii Fit game developed exercises that resembles walking, jogging, and cycling. The purpose of this study was to compare a Wii Fit cardiovascular workout regimen to the traditional cardiovascular exercises walking or running. The study observed 15 participants (10 females, 5 males) over a course of 6 weeks. The participants were split into two different groups: the Wii Fit group and traditional exercise group. The resting heart rate, maximal oxygen uptake (VO_{2max}), resting respiratory change ratio (RER), and electromyogram of the subjects were measured at the beginning of the study, three weeks into the study, and at the end of 6 weeks. Resting RER increased within the subjects over the study period. The VO_{2max} increased amongst the group that participated in the traditional cardiovascular exercise regimen and decreased in the group that participated in the Wii Fit exercise regimen. Resting heart rate decreased with the cardiovascular group but increased with the Wii Fit group. Both the traditional cardiovascular group and Wii Fit group showed an increase in EMG activity but a greater increase was observed within the traditional cardiovascular group. These studies suggest that compared to the Wii Fit exercises, traditional cardiovascular exercise improves an individual's health more.

164. ISOKINETIC ASSESSMENT OF PEAK TORQUE VALUES AND ISOTONIC CONTRACTIONS IN DIVISION I SOFTBALL ATHLETES

Rhonda Cross Beemer, Brittany Perkins, and Kody Lueders
Drake University

The rotator cuff complex is an essential part of throwing in softball; therefore, the strengthening and stabilizing of these muscles helps to lower the risk of injury. Due to the differing throwing techniques in softball athletes, strengthening of various aspects

of the rotator cuff complex may need to be addressed. The purpose of this study was to assess peak torque values of internal and external isotonic contractions among infielders and outfielders of a Division 1 softball team. It was hypothesized that infielders would have higher eccentric peak torque values than outfielders. Thirteen Division 1 female softball players were evaluated by the Biodex isokinetic dynamometer to determine each individual's internal and external concentric and eccentric peak torque values at a 90° shoulder abduction and 90° elbow flexion. Results indicated no significant difference between peak torque values for isotonic contractions among the two field positions, however, did indicate significant differences in peak torque values between internal and external rotation among all individuals. It was also found that subjects with greater active external ROM had greater peak torque values for concentric external rotation and decreases in peak torque values in an eccentric external rotation contraction. These results warrant a need for further investigation.

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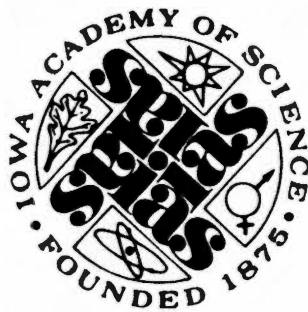
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