

2011


Proceedings of the 123rd Annual Meeting of the Iowa Academy of Science [Program, 2011]

Iowa Academy of Science

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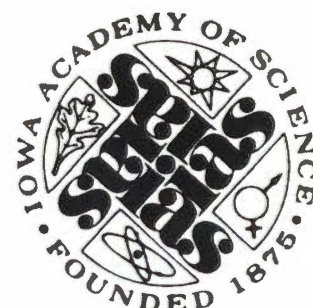
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Proceedings of the 123rd Annual Meeting of the Iowa Academy of Science



April 29-30, 2011
Wartburg College
Waverly, Iowa



PROGRAM SUMMARY

Friday, April 29th

| Time | Events | Location | Page |
|------------|--|---|-------|
| 7:30 | IJAS Registration | Entry, Science Center | |
| 8:00 | Registration Desk Opens | Entry, Science Center | |
| 9:00-10:30 | Morning Snack | Entry, Science Center | |
| 8:00-10:30 | IJAS Competition Posters | Hall of Champions, The W | 6 |
| 8:00-10:30 | IJAS Competition Oral Presentations | 41, 128, 140, 141, 143, & 145, Science Center | 6 |
| 8:30-10:30 | Using Geographic Information Systems in Iowa's K-16 Classrooms | 134 (Voeks Auditorium), Science Center | 7 |
| 11:00-Noon | General Session I | The Lyceum | 8 |
| Noon-1:15 | IJAS Award Luncheon | Ballroom, Saemann Student Center | 9 |
| 1:30-2:15 | IAS Business Meeting | 102 (Hagemann Auditorium), Science Center | 9-10 |
| 2:30-4:30 | Symposium A—Unintended Health and Environmental Consequences of... | 102 (Hagemann Auditorium), Science Center | 11 |
| 2:30-4:30 | Symposium B—Investigating Forensic Science | 134 (Voeks Auditorium), Science Center | 12 |
| 2:30-4:30 | Symposium C—150th Anniversary—Science and the Civil War | The Lyceum | 13 |
| 2:00-4:30 | Senior Academy Poster Set-Up | Hall of Champions, The W | |
| 4:30 | Senior Poster Session Begins | Hall of Champions, The W | 16-17 |
| 4:45-5:45 | Social Hour at the Senior Poster Session | Hall of Champions, The W | 18 |
| 6:00-7:30 | President's Banquet | Ballroom, Saemann Student Center | 18 |
| 7:45-8:45 | General Session II | The Lyceum | 19 |

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.-3:30 p.m.

PROGRAM SUMMARY

Saturday, April 30th

| Time | Events | Location | Page |
|------------|--|--|-------|
| 8:00 | Registration Desk Opens | Entry, Science Center | |
| 8:00-10:30 | Morning Snack | Entry, Science Center | |
| 8:20-10:45 | Section Meetings | See pages 24-29 | 24-29 |
| 11:00-Noon | General Session III | The Lyceum | 20 |
| Noon-1:15 | ESTA Award Luncheon | Ballroom, Saemann Student Center | 21 |
| 1:00-3:00 | Auction items may be picked up | Entry, Science Center | |
| 1:15-2:30 | Section Meetings continue | See pages 24-29 | 24-29 |
| 1:30-2:45 | Special Session—Leading Place-based Student Investigations—Water | 141, Science Center | 22 |
| 2:00 | Geological Society of Iowa Field Trip (snack provided) | Meet in the West F parking lot | 23 |
| 2:45-3:30 | TriBeta Award Ceremony | 134 (Voeks Auditorium), Science Center | 22 |
| 2:30-3:00 | Afternoon Snack | Entry, Science Center | |
| 2:30-5:00 | Section Meetings continue | See pages 24-29 | 24-29 |

Book Store: East Entry, Science Center

Silent Auction: Ballroom, Saemann Student Center, ONLY AVAILABLE DURING MEALS

ACKNOWLEDGEMENTS

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Special Thanks

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

Wartburg College President Darrel Colson
Wartburg College and the Science Center
Campus Host, Johanna Foster

Jean Buckingham
Margret Empie
Pat Finnerty
Jeff Hemingson
Ann Henninger
Jet Propulsion Laboratory, NASA
Sherman Lundy
Ferol Menzel
Mary Peters
Rockwell Collins
Tri-Beta (βββ)
USGS, Cascades Volcano Observatory
Geological Society of Iowa
USGS, Iowa Water Science Center
Jim Waterbury
Robert Watson
Jim Wertz

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

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.

The Iowa Academy of Science is 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), the Iowa Space Grant Consortium (ISGC), the Iowa Mathematics and Science Coalition and the Iowa Mathematics, and Science Education Partnership (IMSEP).

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WELCOME

I feel privileged to have the opportunity to welcome all members and affiliated members, guests, invited speakers, students, and friends to the Iowa Academy of Science 123rd Annual Meeting hosted by Wartburg College in Waverly. I look forward to talking with many of you at the President's Banquet and throughout the meeting. I encourage each of you to participate fully in scientific discourse with your colleagues from around the State of Iowa during the programs, sessions, and in conversations over lunch or dinner.



The Iowa Academy of Science Annual Meeting provides an excellent opportunity for scientists, science educators, science students, and science enthusiasts to come together to share ideas, research, educational approaches, and the many exciting scientific endeavors going on in Iowa. We have many excellent opportunities to learn more about science in topics ranging from robots to volcanoes and from Civil War medicine to modern medical concerns relating to confinement agriculture.

I encourage each of you to enjoy your time at the 123rd Annual Meeting of the Iowa Academy of Science and I especially encourage those of you with more experience in the scientific community to strike up a conversation with the high school and college students of science who will be joining us at the meeting.

Jim Colbert
President, Iowa Academy of Science

IJAS COMPETITION

Poster Displays, Hall of Champions, The W, Friday, 8:30-1:15

Presentations, Science Center, Friday, 8:30-10:45

The Iowa Academy of Science established the Iowa Junior Academy of Science in 1932 with the goal of encouraging schools to develop science clubs and other special science programs. Since that time, IJAS has continually provided middle and high school students with resources and opportunities promoting student research.

The IJAS Competition takes place from 8:30-10:30 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 \$8,500 for this year's competition with the stipulation that IAS must raise an additional \$8500 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 2011 AmJAS

2011 Delegates: Caylie Hawkins, Minna Mohammadi, Pearl Sawhney

2011 Alternates: Kayla Hasper, Carmen Ridgway

2010-2011 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's awardees are:

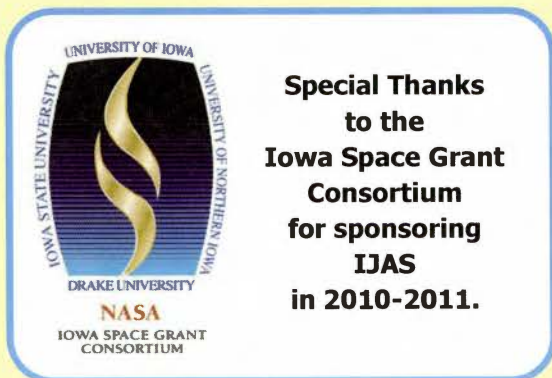
- Aparna Ajarapu
- Hannah Bengtson
- Jennifer Berg
- Allye Bodholdt
- Grace Bogdanove
- Kelsey Bryant
- Micaela Bryant
- Tia Cavender
- Matt Constant
- Luis Galle
- Charissa Galvan
- Laura Graveline
- Garrett Greenfield
- Manisha Gore
- Hans Halverson
- Jessica Harvey
- Shay Haverkamp
- Ethan Hellweg
- Patricia Kim
- Stefan A. Kraus
- Elaine Kushkowski
- Heather Lambert
- Kelsy Lartius
- Daniel Lee
- Tomas Lence
- Julia Lippolis
- Lupe Macintosh
- Mica Katrina D. Magtoto
- Lucy Meng
- Hannah Newell
- Elizabeth Nutty
- Crystal Owens
- Naomi Peterson
- Samuel Roberts
- Kenny Slagell
- Christopher Stoker
- Stella Maris Strohmman
- Michaela Wheatley
- Christina Zhao

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 and alternates.

Iowa's 2011 Delegates:
Rachel Thies, Shelby
Nicholas Moellers, Davenport

Iowa's 2011 Alternate:
Atreya Dey, Fairfield



WORKSHOP

Using Geographic Information Systems in Iowa's K-16 Classrooms
134 (Voeks Auditorium), Science Center, Friday, 8:30 a.m.-10:30a.m.

This workshop will provide attendees with:

- a basic working knowledge of Geographic Information Systems and how they may be effectively applied to their own science curriculum, activities, and place-based learning systems.
- knowledge of where and how to access personalized, free, software, and data that they may use to develop their own projects.
- access to mobile GIS technologies, data storage capabilities, and effective teaching strategies.
- an opportunity to interact with K-12 teachers that are developing their own GIS activities for a variety of science classes, learn the positive and challenging aspects of using GIS in the classroom, and such activities can contribute to and enhance the Iowa Core Curriculum specifically developing 21st Century skills and learning through inquiry.
- a chance to win a door prize (GIS Activity Textbook, data DVD, and 1 year subscription to ESRI's ArcView 9.2 software; iTunes gift cards; GIS application books and texts).



Chad Heinzl, Ph.D.

Assistant professor of Geology and Science Education, University of Northern Iowa

Chad was born in Ft. Lauderdale, Florida and raised in Maquoketa, Iowa. He is currently Geology and Science Education at the University of Northern Iowa. Chad was awarded the 2010 UNI College of Natural Science University Book and Supply Outstanding Teacher. He earned his Ph. D. in Geology & Environmental Geosciences from Northern Illinois University in 2005.

Personal Teaching Statement: I believe there is a global need for well-educated/employable geoscience teachers and geologists. Current research suggests there is also an increasing need for public awareness in Iowa regarding: global climate change, environmental sustainability, natural resource management, energy production/conservation, environmental national security, and the important role geoscientists play in addressing these issues. Our civilization is facing

global shortages in basic natural resources including energy (e.g. oil), minerals (e.g. copper), and potable water. The Earth's 'easily' extractible natural resources have been used and we as a civilization need geoscientists to explore for the remaining (hard to find) resources, develop alternative energy sources, and help educate the public about the Earth's complex systems.

Field experiences assist learners in obtaining one of the most basic and important skills a scientist can possess, observation. Artists 'see' a human face and are able to transfer that mental image to a piece of paper. Non artistic people 'see' the same face, but are unable to accurately convey what they see to the paper. A common phrase in geology is "He or she who sees the most landscapes wins". Developing the ability to truly see a landscape as an artist 'sees' a face takes talent, opportunities, and time. My primary teaching goal is to lead my students through experiences that develop their abilities to characterize and appreciate their natural world. I believe that if my students are to truly understand the dynamic processes that shape our landscapes and lives, they must view and investigate these processes in person.

My basic teaching philosophy may be summed up by the following quote - Education should provide the tools for a widening and deepening of life, for increased appreciation of all one sees or experiences. It should equip a person to live well, to understand what is happening about him/her, for to live well one must live with awareness. - Louis L'Amour

I grew up in eastern Iowa and feel a tremendous sense of responsibility to help Iowa's students reach their full potential. I am working very hard to fulfill this responsibility by reaching out to my students on every possible level including - the classroom, field trips, technology (Twitter, Facebook, mobile computing), office hours, and as a mentor (on and off campus). I am very grateful to have a job at the University of Northern Iowa, but to me my position is much more than a job it is an opportunity to support Iowa's K-12 teachers and inspire our students to succeed.

GENERAL SESSION I

The Lyceum, Friday, 11:00 a.m.

Roaming Mars, a Personal Perspective

Scott G. Lever

Mission Manager, Mars Exploration Rovers Project, Jet Propulsion Laboratory

Since landing on opposite sides of Mars during January of 2004, Spirit and Opportunity have made important discoveries about historically wet and violent environments on ancient Mars. They also have returned more than a quarter-million images, driven more than 34 kilometers (over 20 miles), climbed a mountain, descended into craters, struggled with sand traps and aging hardware, survived dust storms, and relayed enormous amounts of useful data via NASA's Mars Odyssey orbiter.



Courtesy NASA/JPL-Caltech.

Scott Lever has participated in several JPL flight projects since he joined the Jet Propulsion Laboratory in 1984, including: Voyager, TOPEX/Poseidon, Cassini, Spitzer Space Telescope, and as a Mission Manager on the Mars Exploration Rovers (MER) Project. Scott attended the United States Naval Academy, California State University at Los Angeles, and holds a Masters degree in Computer Science from Azusa Pacific University.



Courtesy NASA/JPL-Caltech.

Scott will describe the preparation to develop the rovers, include a video simulation of a launch and landing, road maps, science results, as well as several problems that were encountered. He will describe how the team goes through the daily process of building the commands to control the rovers' behavior and present images of hills, dunes, craters, weather, and blueberries! He will include a discussion of advances in robotic autonomous behavior being used on Mars and reveal the first ever stratigraphic column from another planet. The audience will experience the beauty of Mars in both 2 and 3 dimensions, as several 3D anaglyphs are included.



Courtesy NASA/JPL-Caltech.

IJAS AWARD LUNCHEON

Ballroom, Saemann Student Center, Friday, noon.



Luncheon Program

Announcement of IJAS Competition Awards

Most Promising Young Scientist

Iowa Delegates of the American Junior Academy of Science, 2012

Iowa Alternate Delegates to the American Junior Academy of Science, 2012

IJAS \$500 Senior Scholarships

Iowa's 2011 National Youth Science Camp Delegates

Recognition of all IJAS Members, Judges and Sponsors

BUSINESS MEETING

102, Science Center, 1:30-2:15 p.m.

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

- Andrew Brittingham, Des Moines University
- Jacqueline W. Brittingham, Simpson College
- Donald C. Beitz, Iowa State University

Executive Director Annual Report

New Business

Adjournment

Necrology

April 2010—Present

Mary Alice Ericson, April 2009

Herbert Hodges, November 2009

Frank F. Jaszcz, Jr., July 2010

Clifford G. McCollum, May 2010

Regis D. Voss, November 2010

Ronald Wilmot, June 2008



2010-2011 VOLUNTEERS

"Everybody can be great. Because anybody can serve. You don't have to have a college degree to serve. You don't have to make your subject and your verb agree to serve.... You don't have to know the second theory of thermodynamics in physics to serve. You only need a heart full of grace." ~Martin Luther King, Jr. Thank you 2010-2011 IAS Volunteers.

Section Chairs & Vice Chairs

Anthropology Section

Chair: Sarah Horgen

Vice Chair: Vacant

Cellular, Molecular & Microbiology Section

Chair: Marie Nguyen

Vice Chair: Jodi McKay

Chemistry Section

Chair: Melanie Mauser

Vice Chair: David Dozark

Community College Biologists Section

Chair: Gary Donnermeyer

Vice Chair: Gary Phillips

Ecology & Conservation Section

Chair: James Stroh

Vice Chair: Aaron Haines

Engineering Section

Chair: Albert Ratner

Vice Chair: Thomas Rudolphi

Environmental Science & Health Section

Chair: Kavita Dhanwada

Vice Chair: Melinda Coogan

Geology Section

Chair: Thomas Marshall

Vice Chair: Lee Potter

Iowa Science Teaching Section

Chair: Kathy Megivern

Vice Chair: Adam Puderbaugh

Organismal Biology Section

Chair: Jacqueline Brittingham

Vice Chair: Nicole Palenske

Physics, Atmospheric & Space Sciences Section

Chair: Bion Pierson

Vice Chair: Vacant

Physiology & Health Sciences Section

Chair: Julia Moffitt

Vice Chair: Harold Strauss

Special Projects

Saylorville Gift Shop Coordinator, Gene A. Lucas

ESTA Chair, Tom Ervin (2013)

Myrle Burk Scholarship Committee, Neal Bernstein, Lyn Countryman, Dennis Schlicht

Committees

Committees on Committees and Elections

Tom Rosburg, Steve Main (2011), Gale Vermuelen (2011), Sherman Lundy (2012), Tom Fenton (2012), Paul Mayes (2013), Yvette McCulley (2013)

Conservation & Preserves Committee

Neil Bernstein (2011), Terry VanDeWalle (2011), Rick Hall (2012), Paul Weihe (2012), Gary Phillips (2013), Rebecca Christoffel (2013)

Finance Committee

Pat Finnerty (2011), Jim Pease (2011), A. R. Philp (2012), Paul Hutchinson (2012), Jeff Weld (2013), Daryl Smith (2013)

Iowa Science Foundation Committee

Samina Akbar (2011), Elizabeth Lynch (2011), David Dozard (2012), Vacant (2012), Stephanie Toering Peters (2013), Rhawn Denniston (2012)

Membership Committee

Phyllis Anderson (2011), Matt McAndrew (2011), Gary Fulton (2012), Mary Lestina (2012), Tammie Atchison (2013), Scott Figdore (2013)

Recognition and Awards Committee

Deb Lewis (2011), Paul Mayes (2011), Alison Beharka (2012), Johanna Kruckeberg (2012), Rick Lampe (2013), Karen Wignall (2013)

Societal Issues Committee

Paul Bartelt (2011), Todd Tracy (2011), Name Jim Demastes (2012), Sara Tolsma (2012), Melinda Coogan (2013), Mary Skopec (2013)

Student Programs Committee

Carol Boyce (2011), Michaela Rich (2011), Mark Anderson (2012), Alicia Schiller-Holland (2012), Mario Affatigato (2013), Kelen Panec (2013)

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John Pearson

SYMPOSIUM A

102, Science Center, Friday, 2:30-4:30 p.m.

Unintended Health and Environmental Consequences of Confinement Agriculture



The Rural Iowa Environment and Asthma

Joel N. Kline, Director UI Asthma Center, Division of Pulmonary, Critical Care, & Occupational Medicine, University of Iowa

Dr. Kline will discuss the prevalence and severity of asthma in Iowa and factors associated with its presentation worldwide. He will discuss research from his own laboratory and others carried out at the University of Iowa that suggest a link between asthma and agricultural exposures, and will contrast these with international studies showing that living and working on farms may have a protective effect on the risk of asthma and other allergic disorders.



Photo by Keith Weller, USDA, ARS



Agriculture and Antibiotic Resistance

Tara C. Smith, Assistant Professor, Department of Epidemiology, University of Iowa

Antibiotics are commonly used in both human and animal populations. The use of antibiotics in either group may result in the generation of bacteria which carry resistance to these important drugs. In the agricultural setting, antibiotic-resistant bacteria may be passed to human populations via direct contact with animals or the contaminated environment (putting farmers and meat-processing workers at risk), or via contact or consumption of meat products. Because bacteria can also swap genes encoding antibiotic resistance, bacteria which have never been on a farm may also acquire farm-origin antibiotic-resistance genes, and these may further spread in the human population. This talk will focus on the current state of knowledge of agriculture and antibiotic-resistant bacteria, focusing on methicillin-resistant *Staphylococcus aureus* (MRSA).



Why Confinement Technology Creates Unintended Consequences

Robert P. Watson, Owner, Watson Brothers, Waste Water Manufacturer's Service Provider's Representative

Human endeavors frequently create unintended consequences. Robert Watson will discuss the technology used in industrial confinement agriculture, the environment the technology generates, and how that environment allows for health consequences such as antibiotic resistance and asthma. Mr. Watson will suggest ways to mitigate these problems through a new model for agriculture.

SYMPOSIUM B

134, Science Center, Friday, 2:30-4:30 p.m.

Investigating Forensic Science



Where are the Forensic Scientists?

Gilbert E. Corrigan, MD, PhD

We know what forensic science is but we have to ask "where are the forensic scientists?" We need to use the forensic scientists for pretrial, trial, and post-trial expertise. That is, we need to use them as "experts." Forensic scientists are essential for the function of our court system. "Where are the forensic scientists?" introduces

the concept of the identification of those who are expert witnesses in courts of law both in the facts defined and the theory applied. All scientists may consider themselves as potential expert witnesses both in the work that they do or the theory they generate.

The immunity of some trial lawyers to understanding and using scientific evidence is not gone. Their reliance on jury arguments of "common sense" and "common reality" is not to be denied. Both sides of the bench suffer from their negligence of scientific opinion. The role of laboratory standards and certified laboratories in promoting good forensic practice is obvious. However the importance of in-depth cross examination of the diagnosing scientist is the root of good trial practice.



An overview of the Iowa Division of Criminal Investigation's Forensic DNA Casework and DNA Profiling Units

Mike Halverson, Criminalist/DNA Technical Leader, Iowa Division of Criminal Investigation, Criminalistics Laboratory

The DNA Unit of the DCI Crime Laboratory is comprised of two sections. One is the Casework Section that processes evidence collected at crime scenes from across the State of Iowa and the other is the Databasing Section which develops DNA profiles of convicted offenders within the State of Iowa. The Casework Section processes items of evidence from death investigations, attempted murders, sexual assaults, burglaries, and several other types of criminal activity. An over view will be given of how the evidence from a case is processed, the amount of time it takes to process a case, and what are some of the limitations to DNA testing. The Databasing Section develops DNA profiles from known samples of anyone convicted of a felony within the State of Iowa. These profiles are then uploaded into CODIS and are searched at State and National levels. A "hit" against these samples may result in a case being solved either in Iowa or nationally.



Detection, Documentation, and Collection of Forensic Evidence

Steven L. Petersen, Detective Sergeant, Black Hawk County Sheriff's Department

Iowa law enforcement agencies respond to numerous types of crime and have the responsibility of locating, preserving, documenting, and collecting many forms of evidence. Many agencies rely on the Iowa DCI Crime Laboratory for examination and comparison of the submitted evidence and in major cases the DCI Lab will respond to the crime scene.

SYMPOSIUM C

The Lyceum, Friday, 2:30-4:30 p.m.

150th Anniversary—Science and the Civil War

Overview of Civil War Medicine

Gordon E. Dammann, DDS, Lena, Illinois

Disease was the greatest killer of soldiers during the Civil War. Gordon Dammann will discuss the major diseases that affected the soldiers including the causes and "cures." The treatments were formulated based on the medical education in the 1840s, the time when many of the Union and CSA surgeons were trained. Anesthesia was introduced in 1846 and was used quite effectively to ease suffering of the soldiers. Dr. Dammann will also discuss the profession of nursing, hospital care of the time, and advances in removing the wounded from the battlefield.



Photo by Ryan Somma,
CC BY-SA 2.0

Geology and the Civil War in Missouri

Kevin R. Evans, Associate Professor of Geology and Earth Science Education Coordinator, Missouri State University

Geology had an profound influence on the conduct of the Civil War in Missouri. Although Missourians mostly held southern sympathies, Union forces stationed in St. Louis quickly established control over transportation networks, principally railroads and major rivers. Securing the Rolla–Springfield corridor was pivotal for Union operations in the southwest. Terrain dictated the style of engagements. Large-scale battles, such as Wilson's Creek (Oak Hills) were relatively rare because the hills and hollows were ill-suited for battlefield communications. After the majority of Missouri's southern forces were drawn from the Trans-Mississippi theater into the conflict in the east, militia and guerrilla warfare became modus operandi for opposing sides until late in the war. Forest cover and terrain were ideal for ambushes and hit-and-run attacks. Principal among strategic targets were the mineral resources of the Ozarks, which provided materiel for the conflict. Lead mines at Granby and iron mines at Pilot Knob changed hands a few times during the war.

Men Under Fire: Civil War Tactics, A Step Behind the Advance of Science

Ken L. Lyftogt, Department of History at the University of Northern Iowa

As an infantryman's war, Ken Lyftogt will describe the Civil War's 18th century origin of infantry formations and their purpose. Scientific advances in the use of rifled muskets and repeating rifles made the standard infantry formations obsolete. The mass use of rifled muskets used what is known as the mini-ball. The armaments used during the war were subject to military and governmental politics of which both were impediments to adapting to scientific advances. Ken will include two battlefield examples. "Pickett's Charge" at the battle of Gettysburg, and U.S. Grant's failure at the battle of Cold harbor as examples of the success of rifled muskets using the mini-ball. He will use the history of General Hiram Berdan's sharpshooters as an example of the failed potential of repeating rifles which was connected to the politics of Civil War armaments.

SYMPOSIA PRESENTER BIOGRAPHIES

Gilbert E. Corrigan

Gilbert E. Corrigan was born on May 3, 1929 and grew up during the Great Depression and World War II. His father was a trial lawyer and his mother a journalist. He majored in football in high school but became a biologist while attending Adelbert College of Western Reserve University, majoring in evolution and genetics. He studied evolution at the Notre Dame University and moved to The Ohio State University where he studied human genetics and anatomy. He taught anatomy at Wayne State University in Detroit and graduated from medical school with honors in psychiatry. Following his internship he qualified in pathology by training at The Ohio State University, Boston Children's Hospital, and the Maryland Medical Examiner's Office. He has practiced pathology over 40 years at ten different institutions. He is Board Certified in anatomical and forensic pathology. He plays the saxophone and is an active member of the St. Louis Track Club. He resides in St. Louis with his nurse wife, Esther.

Gordon E. Dammann

Dr. Gordon Dammann is a practicing dentist in Lena, Illinois. He holds a BS from Loyola University, Chicago and a DDS from Loyola University Dental School. He is founder and chairman of the board of the National Museum of Civil War Medicine located in Frederick, MD. He has authored Vols I,II & III of the *Pictorial Encyclopedia of Civil War Medical Instruments and Equipment and Images of Civil War Medicine – A Pictorial History*. Dr. Dammann is active in numerous Civil War, professional, and civic organizations.

Kevin R. Evans

Kevin R. Evans, Ph.D., Associate Professor of Geology and Earth Science Education Coordinator at Missouri State University, is a native Missourian who has a passion for geology and history. With expertise in carbonate sedimentology and stratigraphy, his studies have given him the opportunity to do three seasons of field work in Antarctica, field work in Arctic Alaska, research cruises along coastal California, and stratigraphic studies in Nevada, Utah, and Wyoming. Geology can provide a compelling perspective for understanding historical events; this understanding can be applied to place-based learning in the classroom and in curriculum development for Earth Science education. Dr. Evans completed his undergraduate degree in geology at Missouri State University and received his master's and doctoral degrees from the University of Kansas. He has worked seven years with the U.S. Geological Survey and, in 2002, returned to Missouri State University to teach.

Mike Halverson

Mike Halverson graduated from South Dakota State University in Brookings, SD with a M.S. in Microbiology. He was employed by the Iowa DCI in 2000 and was promoted to Criminalist in the DNA Section in 2001. As DNA Technical Leader he is also part of the DCI's crime scene response team. His training includes DNA testing, crime scene processing, photography, and blood-spatter interpretation. He has testified numerous times across Iowa as an expert witness on DNA and crime scene evidence.

Joel N. Kline

Dr. Kline is Professor in Internal Medicine and in Occupational and Environmental Medicine at the University of Iowa. He developed and directs the University of Iowa Asthma Center, which promotes clinical care, research, and education related to asthma. He directs the Clinical Research Unit of the University of Iowa Institute for Clinical and Translational Science, and is Associate Director of the Environmental Health Science Research Center. His research (both animal and clinical) is focused on asthma and airway inflammation, and he has participated in numerous clinical trials on asthma and allergy therapy.

Ken L. Lyftogt

Kenneth Lyftogt is a lecturer in the Department of History at the University of Northern Iowa and teaches Humanities and U.S. History courses. As a young man Lyftogt was a drifter/writer traveling the highways of the country in search of stories. His travels inspired two novels, Road Freaks of Trans-Amerika (1975) and Highway 13 (1993). His travels, eventually, focused on walking the battle lines of many of the battlefields of the Civil War. He also participated in Civil War reenactments, including being one of the thousands appearing the battle scenes of the movies, North and South II, and Glory. Lyftogt's interest in the Civil War centers on the role of Iowa in the war, particularly that of the soldiers and civilians from the Cedar Valley. He is the author of three books on Iowa and the Civil War; Iowa's Forgotten General: Matthew Mark Trumbull and the Civil War, From Blue Mills to Columbia: Cedar Falls, and the Civil War, and Left For Dixie: The Civil War Diary of John Rath.

Steven L. Petersen

Steve Petersen is a lifelong resident of Black Hawk County and a graduate of Hawkeye Institute of Technology's police science program. Steve began his law enforcement career in 1974 and is currently employed with Black Hawk County Sheriff's Office. He has investigated many crime scenes in Black Hawk County and has assisted multiple agencies in surrounding counties over the last 35 years. Having received several hundred hours of training from state and federal agencies Steve is recognized by his peers in Iowa as an expert in crime scene investigations and examination of evidence. He was awarded Iowa's "Deputy Sheriff of the Year" by the Iowa State Sheriff's and Deputies Association for his expertise in processing a major crime against a person that involved collection of scene evidence for animal DNA testing, which resulted in an unprecedented 100% match that aided in conviction of the perpetrator.

Tara C. Smith

Tara C. Smith is currently an assistant professor of Epidemiology at the University of Iowa and interim director of the Center for Emerging Infectious Diseases. She received her B.S. in Biology from Yale University and her PhD in microbial pathogenesis from the University of Toledo. She completed post-doctoral training in molecular epidemiology at the University of Michigan. Her current research investigates the epidemiology of antibiotic-resistant *Staphylococcus aureus* in association with rural and farming exposures.

Tara has also spent considerable time discussing the value of science education and communication. She writes for two online blogs, *The Panda's Thumb* and *Aetiology*. In addition to publishing in scientific journals, she has written books on the topics of Ebola, group A streptococcus, and group B streptococcus.

Robert P. Watson

Bob Watson has worked in the wastewater industry for about twenty years. His company, Watson Brothers, is a Manufacturer's and Service Provider's Representative. Having worked in all areas of wastewater - collection, process, and land application - Bob now works mainly with lagoon plants.

Always interested in education, ten years ago Bob started and continues to chair the Water Sourcebook Committee of the Iowa Water Environment Association (IAWEA). This committee has given away the CD Water Sourcebook to over 400 teachers in 125 school districts. The Sourcebook is a K-12 supplemental science curriculum covering water, wastewater, groundwater, surface water and wetlands. Understanding that there was no longer 'in class' curriculum for water or wastewater operators in Iowa, Bob started the College Curriculum Committee. Working with DMACC, there will now be water and wastewater operator degrees available in the community colleges in Iowa. Along with the 'in class' curriculum, the committee (made up from all four industry groups in Iowa) has also set up a scholarship funding stream through the DMACC Foundation.

SENIOR POSTER SESSION

Hall of Champions, The W

Cellular, Molecular & Microbiology Section

1. CHARACTERIZATION OF THE RNASE T2 PROTEIN FROM *DROSOPHILA MELANOGASTER* AND EVOLUTION OF THIS RNASE FAMILY IN PROTOSTOMES
2. ANTIBIOTIC SYNERGISM AND ANTAGONISM IN CONTROLLING GROWTH BY THE SKIN BACTERIA *STAPHYLOCOCCUS EPIDERMIDIS* AND *STAPHYLOCOCCUS SIMULANS*
3. ISOLATION AND FUNCTIONAL CHARACTERIZATION OF B FUNCTION MADS BOX GENES FROM A LIPLESS MUTANT OF *PHALAENOPSIS* ORCHID
4. DISCOVERING THE GENETIC BASIS OF FLORAL SYMMETRY USING 'MONSTROUS' ORCHIDS
5. EXAMINING THE PUTATIVE ANTIOXIDANT PROPERTIES OF LINOLEIC AND LINOLENIC FATTY ACIDS IN YEAST CELLS
6. CHARACTERIZATION OF *ARABIDOPSIS* ROOT RIBONUCLEASES
7. CAN CURCUMIN CURE CANCER? SHOULD WORMS DRINK RED WINE? SHOULD WORMS EAT PACIFIC YEW? INVESTIGATIONS ON THE IMPACT ON LIFESPAN IN *CAENORHABDITIS ELEGANS*
8. ASSESSING THE GENETIC RELATIONSHIPS BETWEEN MAYFLY (*BAETIS*) POPULATIONS
9. PRAIRIE IN A PETRI DISH
10. COMPARING THE RELATIVE EFFECTIVENESS OF HERBAL MEDICINE AND ANTIBIOTICS IN CONTROLLING GROWTH OF *BACILLUS CEREUS* AND *ESCHERICHIA COLI*
11. INTRODUCING FLUORESCENCE INTO PETUNIA HYBRID
12. AN ATTEMPT TO PREVENT TOOTH DECAY: NEUTRALIZING THE ACID PRODUCED BY BACTERIA IN THE MOUTH
13. ANALYSIS OF CANDIDATE GENES THAT SUPPRESS CHROMOSOME LOSS IN *SACCHAROMYCES CEREVISIAE* MUTANTS WITH DEFECTS IN CHROMOSOME TRANSMISSION ^{ISF}
14. THE ROLE OF GLUTATHIONE PEROXIDASE AND CATALASE IN MEDIATING THE ANTIOXIDANT PROPERTIES OF PROLINE IN *SACCHAROMYCES CEREVISIAE*
15. BIOACTIVITY ASSAY OF BDNF AND GDNF SECRETED BY ENGINEERED MOUSE MESENCHYMAL STEM CELLS

Chemistry Section

23. BEYOND OCTANITROCUBANE: ASSESSING THE EFFECTIVENESS OF THEORETICAL OCTANITRO C-8 COMPOUNDS AS HIGH ENERGY DENSITY MATERIALS (HEDMS):II

Ecology & Conservation Section

24. THE EFFECT OF BURN TIMING ON GRASSHOPPER AND GROUND BEETLE ASSEMBLAGES IN EARLY STAGE OF A RECONSTRUCTED TALLGRASS PRAIRIE
25. SOUTHERN FLYING SQUIRRELS IN EASTERN IOWA: AN ECOLOGICAL ASSESSMENT
26. ESTIMATION OF WHITE-TAIL DEER DENSITY USING DIGITAL CAMERA TRAPS IN SIOUX CITY, IOWA
27. EXPERIMENTAL POLLINATOR EXCLUSION IN LOW AND HIGH DENSITY STANDS OF *CHAMAECRISTA FASCICULATA* (PARTRIDGE PEA)
28. A PRELIMINARY ANALYSIS OF THE RELATIONSHIP BETWEEN REMNANT PRAIRIE-PATCH SIZE AND INSECT DIVERSITY
29. TEMPORAL VARIATION IN RESPONSES TO CALL-BROADCASTS OF SECRETIVE MARSH-BIRDS IN IOWA
30. RE-EVALUATING TEMPORAL SPACING IN INSECT SAMPLING REGIMES VIA TIMES SCALE CALCULUS ^{ISF}

SENIOR POSTER SESSION

Friday, 4:30-5:45 p.m.

Ecology & Conservation Section continued

31. IDENTIFYING GROUND NEST PREDATORS
32. SURVIVABILITY RATES OF ZOOPLANKTON IN A PASSIVE DISPERSAL SIMULATION
33. POTENTIAL EFFECTS OF PHOSPHATE LEVELS ON ODONATA DIVERSITY IN A NORTHWEST IOWA WETLAND LOCATED IN THE RACCOON RIVER WATERSHED
34. DRINKING IN THE RAIN: A COMPARATIVE STUDY^{BBB}
35. THE EFFECTS OF EUROPEAN BUCKTHORN (*RHAMNUS CATHARTICA*) ON SOIL PROPERTIES IN A RIPARIAN FOREST
36. GENETIC STRUCTURE OF CONTIGUOUS BOBCAT (*LYNX RUFUS*) POPULATIONS IN OREGON^{ISF}
37. CONTROL OF *ALLIARIA PETIOLATA* AND SURVEY OF NATIVE FLORA AT THE YELLOW RIVER FOREST
38. THE EFFECT OF TALLGRASS PRAIRIE SPECIES COMPOSITION ON ABOVE GROUND BIOMASS PRODUCTION
39. REGIONAL ASSESSMENT OF RECOVERY IN PLATTE RIVER WETLANDS USING SOIL AND PLANT INDICATORS
40. GPS Tracking of Ring-necked Pheasants: A Pilot Project
41. RESTORATION OF AN OAK WOODLAND IN NORTHEASTERN IOWA
42. TEMPERATURE SAMPLING IN DENS OF NORTH AMERICAN BADGER, *TAXIDEA TAXUS*

Environmental Science & Health Section

65. FATHEAD MINNOW (*PIMEPHALES PROMELAS*) VITELLOGENIN CONCENTRATIONS BASED ON SIX-DAY BISPHENOL A EXPOSURES

Geology Section

71. SURFICIAL GEOLOGY OF THE DUNKERTON (IOWA) 7.5' QUADRANGLE, BLACK HAWK COUNTY, IOWA
72. MAPPING THE SURFICIAL GEOLOGY OF THE IOWAN EROSION SURFACE, NORTHEASTERN IOWA
73. GIS MAPPING OF GLACIAL ERRATICS, FAYETTE COUNTY, IOWA
74. HEAVY METALS IN CEDAR RIVER SEDIMENTS ASSOCIATED WITH A SHOOTING RANGE IN BLACK HAWK COUNTY

Iowa Science Teaching Section

84. THE EFFECTS OF PROCESS ORIENTED GUIDED-INQUIRY LEARNING (POGIL) IN THE ORGANIC CHEMISTRY CLASSROOM
85. TRENDS IN ENVIRONMENTAL CONCERN BY GRADE LEVEL: A STUDY OF ELEMENTARY, MIDDLE, AND HIGH SCHOOL STUDENTS
86. DEVELOPING VIRTUAL ENVIRONMENTS FOR CONSERVATION EDUCATION: A WORK IN PROGRESS
87. INTRODUCTION TO GIS FOR UNDERGRADUATES IN NATURAL RESOURCE ECOLOGY & MANAGEMENT

Organismal Biology Section

90. DIFFERENCES IN LEG AND PECTORALIS MUSCULATURE IN FACTORY FARM AND FREE-RANGE CHICKENS
91. CLINAL DISTRIBUTION OF CHROMOSOMAL POLYMORPHISM IN *DROSOPHILA AMERICANA*^{BBB}
92. THE EFFECT OF TEMPERATURE ON SEX DETERMINATION AND FITNESS IN PAINTED TURTLES

Physics, Atmospheric & Space Sciences Section

98. FEASIBILITY OF A WIND HYBRID ENERGY FIELD ON UNITED STATES' WATERS

SOCIAL HOUR

Hall of Champions, The W, Saturday, 4:45-5:45 p.m.

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

Be sure to visit the Senior Poster Presentations.

PRESIDENT'S BANQUET

Ballroom, Saemann Student Center, Saturday, 6:00 p.m.



President James Colbert
presiding



Program

Dinner

Welcome and Introductions, Craig Johnson, Executive Director

President's Address by James Colbert

Distinguished Awards

Distinguished Iowa Scientist - Lloyd L. Anderson, Iowa State University

Distinguished Iowa Scientist - Athanasios N. Papanicolaou, University of Iowa

Distinguished Iowa Scientist - Mark F. Stinski, University of Iowa

Distinguished Iowa Science Teaching - Ronald J. Warnet, Simpson College

Incoming President's Address by Thomas Rosburg

GENERAL SESSION II

The Lyceum, Friday, 7:45 p.m.



Invasive to Innovative:

The Robotic Frontier of Surgery

Steve R. Slessor, MHA

Vice President of Operations, Allen Hospital

Rationale for surgery remains constant, however, the way it is being performed is constantly evolving. This presentation will discuss the major changes in surgery over the last few decades, focusing on the current evolution of robotic surgery. We will explore clinical data, trends, and a case study of Allen Hospital in Waterloo, Iowa. Since its first true introduction a decade ago, the robotic surgery market has expanded dramatically. While initially viewed as an innovative differentiator for academic medical centers, robotic surgery is beginning to show that it can become the national standard of care for some specialties.

The cost/benefit analysis of robotic assisted surgery has been a topic of hot debate, both with physicians and hospital administrators. This debate has been brought to the public with recent articles in major publications. Proponents applaud the initial clinical literature, the expansion of minimally invasive procedures, and reduced patient recovery time. Opponents cite a long learning curve, the lack of rigor in the studies and another major investment in a healthcare system that continues to consume more and more of our GDP.

Whatever the experts believe, it is really the patients driving this change. Today's patients are no longer only concerned with an good clinical outcome; they now expect that same level of care with less pain, reduced scaring and a quicker return to normal function. To achieve this end, patients are beginning to seek out care at facilities providing robotics, meaning that a hospital has to make a decision; either let those patients leave, or join the robotic ranks.

Steve Slessor joined Allen Hospital in 2008. In his three years at Allen, Steve has held positions as the Director of Business Planning and Development and Senior Director of Strategic Development. Most recently, at the age of 27, he was named Vice President of Operations. Allen Hospital is a 204-bed acute-care hospital in Waterloo, Iowa, serving 11,000 inpatient visits and 38,000 outpatient visits annually.

Throughout his time at Allen, Steve has been responsible for coordinating many new developments within the hospital. In 2009, Allen invested in two robotic surgery platforms, the da Vinci Surgical System and the MAKO Surgical System. He was also the lead person for the purchase of the market's leading gastroenterology practice as well as the opening of the new Allen Wound and Hyperbaric Oxygen Center. Currently, he is responsible for administrative oversight of 11 departments accounting for 350 employees. Apart from Allen, Steve serves as the Vice Chairperson for the Highway 63 Community Development Corporation, a group dedicated the economic development of the north-east side of Waterloo.

Steve graduated magna cum laude from the University of Northern Iowa with a Business Administration major and ethics minor. Following his undergraduate work, he received his master's degree in Healthcare Administration from the University of Iowa. He is a member of the American College of Healthcare Executives.

Steve is married to Megan Slessor, an elementary teacher in the Waverly-Shell Rock School District. They live in Cedar Falls with their two cats.



Photo courtesy Mako Surgical.

GENERAL SESSION III

The Lyceum, Saturday, 11:00 a.m.

Challenges and Opportunities for Volcanic Risk Mitigation in the Internet Age

John W. Ewert

Scientist-in-Charge, USGS Cascades Volcano Observatory

Progress in volcanology—understanding how volcanoes move from unrest to eruption and how they impact society—is opportunistic and largely governed by our ability to make observations and test ideas at volcanic eruptions as they occur. Since the watershed 1980 eruption of Mount St. Helens, volcanology has made significant progress, the pace of which is accelerating thanks to our ability to bring sensor platforms and networks and associated research efforts to bear on developing eruptive activity globally. Internet communication facilitates the scientific progress being made.

The collection and interpretation of geophysical and geochemical data on volcanoes has changed over the years from being the exclusive realm of a volcano observatory, with a network of ground-based sensors and observers, to one which is decidedly multidisciplinary, often interagency, and with geographically separated observers. An important reason for this shift is that new tools and techniques developed for other applications (e.g., climate or weather) sometimes aid in tracking volcanic unrest or providing eruption alerts, but data from these ancillary systems are almost never adequate in and of themselves to accurately ascertain the status of an active volcano. There are many data available in one form or another via the Internet, which creates opportunities to accelerate our understanding of volcanic processes. The legitimate role of a volcano observatory is to convert and coordinate these abundant data into useful volcano hazards information in close to real time. Thus, the challenge facing observatories in the 21st century is to assimilate all available data and analyses quickly and efficiently to provide a single source for cogent hazard synthesis in the form of timely forecasts, predictions, or alerts that are useful to communities at risk on the ground and to aviation.



Photo courtesy USGS.

Mr. Ewert is a volcanologist with the U.S. Geological Survey (USGS) where he has worked since 1980. He is stationed at the Cascades Volcano Observatory in Vancouver, Washington. His entire career has been spent working on matters pertaining to explosive volcanism, volcano monitoring and volcano hazards mitigation in the United States and around the Pacific Rim.

He has a Bachelor's degree in geology from Beloit College, (Beloit, WI) and completed two years of graduate study at Oregon State University. From 1980 to 1986 he worked at Mount St. Helens on various research projects pertaining to volcanic gas emissions and ground deformation over the course of 15 eruptions, as well as working on projects at other Cascade Range volcanoes.

He was one of the founding members in 1986 of the Volcano Disaster Assistance Program (VDAP), a joint US Agency for International Development-USGS program that works with foreign counterparts to monitor volcanoes, forecast eruptions, assess and mitigate hazards and improve understanding of volcanic processes. Since 1986, VDAP has built volcano monitoring infrastructure in 12 countries, responded to 26 major volcano crises, and has saved tens of thousands of lives and hundreds of millions of dollars of property. A highlight of his work with VDAP occurred in 1991 when he was part of the USGS team working at Clark Air Base, Philippines, prior to and during the eruption of Mount Pinatubo, one of the largest eruptions of the 20th century.



ESTA LUNCHEON

Ballroom, Saemann Student Center, Friday, noon.

2011 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.

2011 ESTA Awardees

David D. Langtimm-Elementary Science
Riverdale Heights Elementary School, Bettendorf

Justin R. Johnson-Middle/Junior High Science
Central Middle School, Muscatine

Aileen Mahood Sullivan-Physical Science
Ames High School, Ames

Teri L. Wiese-Life Science
North High School, Davenport

Jesse L. Wilcox-General/Multiple Science
Valley Southwoods High School, West Des Moines

Kathy D. Hobson-Earth, Space, Environmental Science
Atlantic High School, Atlantic

Recognition of the 2010 Science Nominees for the Presidents' Award for Excellence in Mathematics and Science Teaching



Mason Kuhn

Mason Kuhn
Shell Rock Elementary,
Waverly-Shell Rock

and

Brandon Schrauth
Beaver Creek Elementary,
Johnston



Brandon Schrauth

**Save the Date for ISTS
Fall Conference**

Soar to the Core

Monday & Tuesday
October 17th-18th, 2011
Scheman Center
on the ISU Campus,
Ames

<http://ists.pls.uni.edu/>

SPECIAL EVENTS

Leading Place-based Student Investigations—Water

Science Center, Room 141, 1:30-2:45 p.m. Saturday

Leading Place-based Student Investigations—Water is a pilot professional development course designed by the Iowa Academy of Science and Iowa Department of Natural Resources Aquatic Education Program. Participants, 4th-8th 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 share their student investigation projects and results. Time will be set aside for an informal discussion with participants.

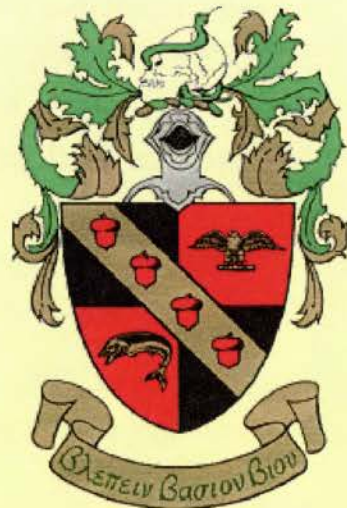


Tri-Beta Award Ceremony

134 (Voeks Auditorium), Science Center, 2:45-3:30 p.m. Saturday

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 life-time 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.



The Geological Society of Iowa 2011 Spring Field Trip The Geological Wonders of Bremer County



2:00 p.m. Saturday

The 2011 GSI Spring Field Trip is open to all registered attendees and has two stops: South Riverside Park and the Tripoli-Platte quarry. The first stop will be at South Riverside Park where participants will get a chance to look at the lower Devonian Little Cedar Formation. The Little Cedar Formation is fossiliferous, especially with brachiopods. The park overlooks the Cedar River, giving opportunity for a discussion of water quality and flooding issues in the area. The second stop of the day will be at the Tripoli-Platte quarry operated by Paul Niemann Construction Company. On this stop, we will see the Silurian lower Hopkinton Formation. Fossils include large *Pentamerus* brachiopods and corals. There is also a giant complex carbonate mound. Field trip leaders are Robert McKay, Chad Fields, Stephanie Tassier-Surine, and Thomas Marshall of the Iowa Geological and Water Survey.

Because the geology section session of the Iowa Academy of Science will run into the afternoon, the field trip will begin at 2:00 PM. Please meet at the West F Parking Lot south of and across the street from the Science Center. We will travel by personal car caravan to South Riverside Park in town and then to the Tripoli-Platte quarry. This trip is free and open to the public. Maps are available at the registration desk.

Participants are asked to bring hard hats if they have them (GSI will have some for those who need them), eye protection (safety glasses, regular glasses, or sun glasses) and closed-toe shoes (preferably leather boots). Please do not wear sandals or flip-flops. Rock collecting in the quarry will be allowed and encouraged!



*Photos of past GIS Field Trip
Courtesy Raymond Anderson*

SECTION MEETINGS

Anthropology Section

Anthropology Section has no presentations this year.

Cellular, Molecular & Microbiology Section

8:20-1:55, Science Center, Room 145

- 8:20 16. THE EFFECTS OF LAURICIDIN/GML ON TNF- α PRODUCTION IN MURINE MACROPHAGE CELLS^{BBB}
- 8:40 17. SCOLEXIN DETECTION IN *MANDUCA SEXTA* LARVAE^{BBB}
- 9:00 18. SHINING A LIGHT ON THE EXPRESSION OF HETEROLOGOUS PROTEINS IN HYBRID *PHALAENOPSIS* AND *PETUNIA* HYBRID
- 9:20 Break
- 9:40 19. COMPETITION OF METHICILLIN-SUSCEPTIBLE ASYMPTOMATIC CARRIAGE *S. AUREUS* ISOLATES AND USA300, A METHICILLIN-RESISTANT STRAIN
- 10:00 20. SUPPRESSION OF YEAST FILAMENTOUS GROWTH BY BORIC ACID
- 10:20 Section Business Meeting: Election of New Officers & New Business
- 11:00 General Session III—Challenges and Opportunities for Volcanic Risk Mitigation in the Internet Age
- 12:00 Excellence in Science Teaching Awards Luncheon
- 1:15 21. DIGEORGE CRITICAL REGION 6 (DGCR6) INTERACTS WITH PROTEIN INTERACTING WITH C KINASE (PICK1) WHEN PICK 1 IS BOUND TO A PDZ DOMAIN BINDING PROTEIN
- 1:35 22. STRESS, ALCOHOL, AND DRUGS: EFFECTS ON THE LONGEVITY OF *CAENORHABDITIS ELEGANS*

Chemistry Section

Chemistry Section has no presentations this year.

Community College Biologists Section

1:15-2:00, Science Center, Room 345

- 1:15 Section Business Meeting: Old & New Business.

SECTION MEETINGS

Ecology & Conservation Section

8:20-4:35, Science Center, Room 214

- 8:20 43. RESPONSE OF AMPHIBIANS TO RESTORED WETLANDS ON AN AGRICULTURAL LANDSCAPE: PRELIMINARY RESULTS
- 8:40 44. RESPONSE OF A YELLOW MUD TURTLE (*KINOSTERNON FLAVESCENS*) COMMUNITY TO HABITAT CHANGE: MANAGEMENT IMPLICATIONS FOR A NATURE PRESERVE
- 9:00 45. USE OF AN ARTIFICIAL HABITAT BY RACERUNNERS (*ASPIDOSCELIS SEXLINEATA*)^{BBB}
- 9:20 46. DEPTH DISTRIBUTION OF COMMON *HOLOTHURIA MEXICANA* (DONKEY DUNG SEA CUCUMBER) VERSUS ITS ELONGATED LENGTH
- 9:40 47. BY THE NUMBERS: HOW IS RECOVERY DEFINED BY THE U.S. ENDANGERED SPECIES ACT?
- 10:00 48. CLIMATE CHANGE IMPACTS ON IOWA'S FLORA AND FAUNA: AN INITIAL ASSESSMENT
- 10:20 Section Business Meeting: Election of New Officers & New Business
- 11:00 General Session III—Challenges and Opportunities for Volcanic Risk Mitigation in the Internet Age
- 12:00 Excellence in Science Teaching Awards Luncheon
- 1:15 49. IMPACTS OF GOAT BROWSING ON MICROCLIMATES AND PHOTOSYNTHETIC RATES IN A SAVANNA RESTORATION
- 1:35 50. AVIAN COLONIZATION DURING EARLY ESTABLISHMENT IN A PRAIRIE BIOFUEL PROJECT
- 1:55 51. BUTTERFLY RESPONSE TO FLORAL RESOURCES DURING EARLY ESTABLISHMENT AT A HETEROGENEOUS PRAIRIE BIOMASS PRODUCTION SITE
- 2:15 52. COMPARISON OF ORGANIC AND CONVENTIONAL AGRICULTURE SYSTEM EFFECTS ON SOIL QUALITY
- 2:35 53. LOSS OF MILKWEEDS IN CORN AND SOYBEAN FIELDS DUE TO GLYPHOSATE HERBICIDE USE: POTENTIAL EFFECT ON THE MONARCH BUTTERFLY POPULATION
- 2:55 54. LONG-TERM TILLAGE AND CROP ROTATION EFFECTS ON SOIL QUALITY AND PRODUCTIVITY ACROSS IOWA
- 3:15 55. EFFECT OF CORN-COB STORAGE ON FIELD FOR CELLULOSIC ETHANOL PRODUCTION ON SUBSEQUENT CROP DEVELOPMENT AND SOIL QUALITY
- 3:35 56. EDUCATING NEW LEADERS IN CONSERVATION: THE PROFESSIONAL SCIENCE MASTERS IN ECOSYSTEM MANAGEMENT AT UNI
- 3:55 57. UPDATING THE NATURAL AREAS INVENTORY (NAI) DATABASE FOR RARE PLANTS IN IOWA
- 4:15 58. RISK FACTORS ASSOCIATED WITH WEST NILE VIRUS SEROPREVALENCE IN CENTRAL IOWA BIRDS^{ISF}

SECTION MEETINGS

Engineering Section

1:15-3:55, Science Center, Room 140

- 11:00 General Session III—Challenges and Opportunities for Volcanic Risk Mitigation in the Internet Age
- 12:00 Excellence in Science Teaching Awards Luncheon
- 1:15 59. MICROSTRUCTURAL AND ELECTROCHEMICAL IMPEDANCE STUDY OF NI/CGO ANODES FOR SOLID OXIDE FUEL CELLS FABRICATED BY ULTRASONIC SPRAY PYROLYSIS
- 1:35 60. DYNAMIC OPTIMIZATION OF DISTRICT UTILITY GENERATION
- 1:55 61. ANALYSIS OF MEDIUM TO LOW TEMPERATURE PYROLYSIS OF BIOMASS
- 2:15 Break
- 2:35 62. SPACE TECHNOLOGIES FOR MITIGATION OF ASTEROID IMPACT THREATS
- 2:55 63. EFFECT OF EXPOSURE TIME AND SCAN STEP SIZE ON THE SIZE OF ULTRASOUND HISTOTRIPTY LESION
- 3:15 64. FUEL DROP SPREADING ON A SOLID SMOOTH SURFACE: NUMERICAL SIMULATIONS WITH THE VOF METHOD
- 3:35 Section Business Meeting: Election of New Officers & New Business

Environmental Science & Health Section

8:40-10:40, Science Center, Room 245

- 8:40 66. THE EFFECTS OF CADMIUM ON DROSOPHILA MELANOGASTER MATING BEHAVIOR
- 9:00 67. TICK-BORNE PATHOGENS IN WINONA COUNTY: *BORRELIA BURGENDORFERI* AND *ANAPLASMA PHAGOCYTOPHILUM* ^{BBB}
- 9:20 68. METOLACHLOR EXPOSURE LEADS TO CELL CYCLE EFFECTS
- 9:40 69. ATRAZINE METABOLITES, DEA, DIA AND DEDIA AFFECT GROWTH OF HUMAN LIVER CELLS
- 10:00 70. GOING GREEN: ARE GREEN PRODUCTS BETTER FOR THE ENVIRONMENT THAN TRADITIONAL CLEANERS?
- 10:20 Section Business Meeting: Election of New Officers & New Business
- 11:00 General Session III—Challenges and Opportunities for Volcanic Risk Mitigation in the Internet Age
- 12:00 Excellence in Science Teaching Awards Luncheon

SECTION MEETINGS

Geology Section

8:20-1:55, Science Center, Room 244

- 8:20 75. USE OF 3-D AND OTHER MODERN GRAPHIC TOOLS IN GEOLOGICAL INTERPRETATION
- 8:40 76. THE SUBDIVISION OF THE CHEROKEE GROUP ON THE NEW BEDROCK GEOLOGIC MAP OF IOWA
- 9:00 77. INDONESIAN-AUSTRALIAN SUMMER MONSOON VARIABILITY IN THE EARLY HOLOCENE
- 9:20 78. RECONSTRUCTING TROPICAL CYCLONE FREQUENCY USING MUD LAYERS IN SPELEOTHEMS
- 9:40 79. COMBINED STALAGMITE AND LIMPET-BASED HOLOCENE PALEOCLIMATE RECONSTRUCTIONS FROM COASTAL PORTUGAL
- 10:00 80. GEOLOGIC SETTING OF THE WINNESHIEK LAGERSTATTE - DECORAH, IOWA
- 10:20 81. FOSSIL CORALS OF IOWA DATABASE
- 10:40 Section Business Meeting: Election of New Officers
- 11:00 General Session III—Challenges and Opportunities for Volcanic Risk Mitigation in the Internet Age
- 12:00 Excellence in Science Teaching Awards Luncheon
- 1:15 82. GIANT CELLS: EVOLUTIONARY SIZE INCREASE IN FUSULINOIDEAN FORAMINIFERA
- 1:35 83. COMPILING MINERALOGICAL DATA AND REINTERPRETING MINERALIZING EVENTS ASSOCIATED WITH MID-CONTINENT RIFT VOLCANISM IN IOWA: SOME PRELIMINARY OBSERVATIONS
- 1:55 Depart for Field Trip (see page 23)

Iowa Science Teaching Section

9:00-10:40, Science Center, Room 345

- 9:00 88. EII PRESENTS: RAIN, RUNOFF, AND RIVERS: UNDERSTANDING WATERSHEDS
- 9:20 89. SCIENCE SAFETY IN IOWA AND THE NATIONS ACADEMIC SETTINGS: A SERIOUS PROBLEM
- 9:40 Section Business Meeting: Election of New Officers & New Business
- 11:00 General Session III—Challenges and Opportunities for Volcanic Risk Mitigation in the Internet Age
- 12:00 Excellence in Science Teaching Awards Luncheon

SECTION MEETINGS

Organismal Biology Section

8:40-10:40, Science Center, Room 247

- 8:40 93. COLOR PERCEPTION IN *DROSOPHILA MELANOGASTER*
- 9:00 94. INVESTIGATING THE GENETIC BASIS OF TOLERANCE OF ALLELOPATHIC INVADERS
- 9:20 95. DETECTION OF BACTERIA USING PURIFIED FIREFLY LUCIFERASE^{BBB}
- 9:40 96. SPATIO-TEMPORAL VARIATION IN A MISSISSIPPI RIVER TURTLE COMMUNITY
- 10:00 97. COMPARISON OF LEAF CRYSTAL MACROPATTERNS IN THE ALLIED GENERA *PEPEROMIA* AND *PIPER* (PIPERACEAE)
- 10:20 Section Business Meeting: Election of New Officers & New Business
- 11:00 General Session III—Challenges and Opportunities for Volcanic Risk Mitigation in the Internet Age
- 12:00 Excellence in Science Teaching Awards Luncheon

Physics, Atmospheric & Space Sciences Section

8:20-4:55, Science Center, Room 41

- 8:20 99. NANOSTRUCTURED MATERIALS: THE WORLD'S SMALLEST MISTAKES
- 8:40 100. MEASURING THE NEAR-NOTHINGNESS OF INTERSTELLAR SPACE WITH RADIO ASTRONOMY
- 9:00 101. TIME-DEPENDENT PROBLEMS IN RELATIVISTIC QUANTUM MECHANICS
- 9:20 102. GROWTH AND CHARACTERIZATION OF NANOSCALE THIN FILMS
- 9:40 103. PROBING NUCLEON STRUCTURE WITH SPIN AT RHIC
- 10:00 104. VELOCITY, TEMPORAL, AND GENERALIZED KIRCHHOFF GAUGES AND WILTON'S VECTOR DIAGRAM
- 10:20 Section Business Meeting: Election of New Officers & New Business
- 11:00 General Session III—Challenges and Opportunities for Volcanic Risk Mitigation in the Internet Age
- 12:00 Excellence in Science Teaching Awards Luncheon
- 1:15 105. THE PHYSICS OF GRAPHENE
- 1:35 106. VELOCITY REDISTRIBUTION AND HYPERFINE STATE CHANGING COLLISIONS IN RB-AR COLLISIONS
- 1:55 107. MEASURING THE J/ψ AT FORWARD RAPIDITIES IN PHENIX

SECTION MEETINGS

Physics, Atmospheric & Space Sciences Section continued

8:20-4:55, Science Center, Room 41

- 2:15 108. NANOSCALE SURFACE MODIFICATION OF LAYERED MATERIALS
- 2:35 109. MEASUREMENT OF ATOMIC STATE LIFETIMES IN RUBIDIUM AND INELASTIC COLLISION CROSS-SECTIONS IN RUBIDIUM-ARGON
- 2:55 Break
- 3:15 110. SUPERNOVA REMNANTS: RESULTS FROM SUBORBITAL ROCKETS AND BEYOND
- 3:35 111. PHOTOMETRIC AND SPECTROSCOPIC STUDIES OF THE ECLIPSING BINARY STAR SYSTEM ALGOL
- 3:55 112. STORMY (SPACE) WEATHER: AN EMFISIS ON THE RADIATION BELT STORM PROBES
- 4:15 113. APPROXIMATION OF JET AXIS IN RAPIDITY SEPARATED DIHADRON CORRELATIONS
- 4:35 114. ANOMALOUS EMISSION IN THE RESONANCE FLUORESCENCE OF RUBIDIUM IN THE PRESENCE OF ARGON COLLISIONS



Physiology & Health Science Section

10:20-3:15, Science Center, Room 143

- 10:20 Section Business Meeting: Election of New Officers & New Business
- 11:00 General Session III—Challenges and Opportunities for Volcanic Risk Mitigation in the Internet Age
- 12:00 Excellence in Science Teaching Awards Luncheon
- 1:15 115. EXERCISE TRAINING DECREASES THE OCCURRENCE OF CARDIAC ARRHYTHMIAS IN YOUNG AND AGED RATS
- 1:35 116. PRE-EXERCISE DRINKS AND MUSCLE PERFORMANCE: EFFECTS OF GENDER
- 1:55 117. INVESTIGATION OF SURFACE AREA, VOLUME, AND TEMPERATURE IN HUMAN BODY PARTS
- 2:15 118. PHYSIOLOGICAL EFFECTS OF *NOTURUS GYRINUS* EXTRACTS ON *MUS MUSCULUS*^{PPP}
- 2:35 119. SIGNIFICANT DIFFERENCE IN NUMBERS OF BACTERIA ON PAPER CURRENCY FROM A SMALL TOWN BANK AND A LARGE CITY BANK
- 2:55 120. ARE CELL PHONES VIABLE VEHICLES FOR TRANSMISSION OF BACTERIA CAUSING STREP THROAT?

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  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  at the end of the abstract title.

ellular, Molecular & Microbiology Section

Posters

1. CHARACTERIZATION OF THE RNASE T2 PROTEIN FROM *DROSOPHILA MELANOGASTER* AND EVOLUTION OF THIS RNASE FAMILY IN PROTOSTOMES

Ryan Bailey, Linda Ambrosio and Gustavo MacIntosh
Iowa State University

Ribonucleases of the T2 family are RNA degrading enzymes present in almost all higher level organisms. The T2 RNases have been studied extensively in plants, but their role in animals is relatively unknown. In animals, RNase activity has evolved such that many of the biological roles performed by T2 RNases in plants have been taken over by RNases of the RNase A family. Recent research on zebrafish has suggested that the T2 family of enzymes may have been conserved in order to carry out a housekeeping function in animal cells. In order to further understand the role of T2 RNases in animals, phylogenetic analyses and studies of gene expression were carried out on the fruit fly *D. melanogaster*. The genome of this organism contains only one gene of the T2 family, RNase X25. This gene was found to be expressed in all life cycle stages examined, in accordance with the most recent high throughput microarray results available. Additionally, database searches and phylogenetic analyses have shed light on the evolution of the ribonucleases of this family in protostomes. Only one gene, highly conserved, is found on

most animal genomes. Together with ubiquitous expression, this conservation is consistent with a housekeeping role for RNase T2 enzymes. A special case of gene duplication and the possible evolution of new functions in the parasitic wasp *Nasonia vitripennis* are also discussed.

2. ANTIBIOTIC SYNERGISM AND ANTAGONISM IN CONTROLLING GROWTH BY THE SKIN BACTERIA *STAPHYLOCOCCUS EPIDERMIDIS* AND *STAPHYLOCOCCUS SIMULANS*

Austin Ferguson, Tanner Urich and Brian A. Lenzmeier
Buena Vista University

Bacterial resistance to antibiotics is a growing medical concern. We are studying the effects of different antibiotics on the viability of the naturally occurring skin bacterium *Staphylococcus epidermidis* and *Staphylococcus simulans*. Because of the high rate of resistance of bacteria to single antibiotics it is of interest to determine which combinations of antibiotics may be useful in killing bacteria. Specifically, we are interested in determining which combinations of antibiotics work synergistically or antagonistically. Synergistic combinations work better together at lower dosages than using only one antibiotic at a higher dose. Antagonistic combinations work less effectively when given together than they would when taken individually. Two years ago we screened a panel of seven antibiotics for the best synergistic combinations. Last semester we began using liquid cultures of the bacterium and are using three different antibiotic combinations to more closely mimic physiological conditions. We currently are testing for the lowest concentrations of antibiotics that have the ability to work synergistically in killing *S. epidermidis* and *S. simulans*. We will be presenting our results and our future plans of the research.

3. ISOLATION AND FUNCTIONAL CHARACTERIZATION OF B FUNCTION MADS BOX GENES FROM A LIPLESS MUTANT OF *PHALAENOPSIS* ORCHID

Justin Foht, Jamie Cota and Rasika G. Mudalige-Jayawickrama
University of Dubuque

Orchid flowers have two layers of perianth organs, an outer layer of three showy sepals, and an inner layer of two lateral petals and a modified dorsal petal known as the lip. The shape of the lip is one of the most important criteria for determining phylogenetic relationships among orchids. Tsai et al. (2004) have isolated four B function MADS box genes, PeMADS2, PeMADS3, PeMADS4 and PeMADS5, from *Phalaenopsis equestris*. Their results indicated that the absence of PeMADS5 gene and the expansion of PeMADS4 expression from dorsal lip region to lateral petals converted the petals into lips. We have chosen a *Phalaenopsis* grex Elizabeth Hayden, a mutant without a lip, to investigate the role of PeMADS4 gene in lip development. We hypothesized that the PeMADS4 gene will be absent or mutated in lipless flowers of *P. Elizabeth Hayden*. We have isolated all four B function MADS box genes from the mutant and determined their sequence and expression profile in flowers. Surprisingly, the expression profile showed that the PeMADS4 gene is present in all three petals of *P. Elizabeth Hayden*. The expression level for the dorsal petal appeared slightly higher compared to that of lateral petals. Sequence analysis of the deduced amino acid sequence of PeMADS4 of our mutant orchid was identical to that of previously isolated PeMADS4 gene, ruling out the possibility of mutation as the reason for the absence of lip. We have also isolated 2 PeMADS5-like genes from the lipless mutant. We are currently examining the possible role of the additional PeMADS5-like gene in the loss of lip in orchids. We conclude that further research on MADS box genes and their effect on floral architecture is needed to propose an all-inclusive model for orchid lip formation.

4. DISCOVERING THE GENETIC BASIS OF FLORAL SYMMETRY USING 'MONSTROUS' ORCHIDS

Cellese Griffin, Rasmira Ahmetasevic and Rasika G. Mudalige-Jayawickrama
University of Dubuque

The orchid family is one of the most species-rich plant families with obligatory bilateral symmetry (zygomorphy). Orchid floral symmetry is determined by the presence of a highly modified dorsal petal termed lip (labellum) and a column, a structure made by the fusion of the stamen, the

style, and the stigma. The main goal of our research is to isolate and characterize the key genes involved in determining the symmetry of orchids using peloric mutants. In pansy-lip peloria, the modified lip is reverted back to a normal petal, changing the floral symmetry from bilateral to radial. The floral symmetry in *Phalaenopsis* orchid is suggested to be regulated by the differential expression of DEFICIENCE-like (DEF-like) MADS box genes of ABC type floral homoeotic genes. The floral symmetry in several eudicot plant families was proven to be regulated by CYCLOIDEA-like TCP transcription factors. We have isolated four DEF-like MADS box genes (DkMADS genes) from the *Dendrobium* Ethel Kamemoto hybrid. Gene sequence analyses has proven that the DkMADS box are the orthologs of *P. equestris* genes implicated in regulation of floral symmetry. However, the expression profile of one of these genes, DkMADS4, the ortholog of the key gene suggested for control of lip formation, contradicts that of *Phalaenopsis*. Our results suggest that the simple model for orchid floral symmetry based on *Phalaenopsis* MADS box gene expression of three lip peloric orchids might not be applicable to pansy-lip peloria of *Dendrobium*. We have also identified two TCP genes, Den-TCP-1 and Den-TCP-2, differentially expressed between the normal and peloric sibling lines of *D. Ethel Kamemoto*. Both Den-TCP genes contain a conserved microRNA binding domain identical to that of CINCINNATA gene in Antirrhinum. Recently, CINCINNATA-like genes were shown to regulate the petal lobe outgrowth and stamen suppression in *Arabidopsis* model system. We will discuss the possible role of Den-TCP genes, and its regulation by microRNA, in the determination of floral symmetry.

5. EXAMINING THE PUTATIVE ANTIOXIDANT PROPERTIES OF LINOLEIC AND LINOLENIC FATTY ACIDS IN YEAST CELLS

Grant Herrington and Brian A. Lenzmeier
Buena Vista University

The purported antioxidant effects of linoleic and linolenic acids have not been elucidated experimentally at this point in time. This study is being undertaken to investigate the potential role of linoleic and linolenic fatty acids in influencing the ability of yeast cells to survive in conditions of

ABSTRACTS BY SECTION

oxidative stress such as paraquat and hydrogen peroxide exposure. It is hypothesized that linoleic and linolenic acids could potentially serve a protecting role for yeast cells in conditions of oxidative stress. We are currently growing yeast cells in medium with and without the fatty acids and exposing them to various forms of oxidative stress. We will present the findings of these experiments at this meeting.

6. CHARACTERIZATION OF *ARABIDOPSIS* ROOT RIBONUCLEASES

Kirsten Karkow, Melissa Hillwig and Gustavo MacIntosh
Iowa State University

T2 ribonucleases are widely distributed throughout plants, animals, protists, bacteria and viruses, and have been suggested to have a broad range of biological roles. In plants, these endoribonucleases are typically excreted from the cell or confined to the vacuole, though they may also be found in other locations within the cell. *Arabidopsis* contains five T2 ribonucleases, each potentially possessing its own specialized function. While three RNases (RNS1-3) are relatively well characterized, the other two (RNS4 and 5) have not been studied so far. Microarray analyses suggested that these proteins are root-specific. In this work we studied the expression of RNS4 and RNS5 and characterized the RNase profile of *Arabidopsis* roots. We have also isolated an homozygous RNS4 mutant line and identified heterozygous RNS5 mutants that will allow further characterization of the role of these RNases in plant cells.

7. CAN CURCUMIN CURE CANCER? SHOULD WORMS DRINK RED WINE? SHOULD WORMS EAT PACIFIC YEW? INVESTIGATIONS ON THE IMPACT ON LIFESPAN IN *CAENORHABDITIS ELEGANS*

Sarah Larson, Emily Nielsen, James Hampton, Tyler Harm, Miguel Munoz-gomez and Brooke Wehle
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 exhibit-

ing cancer-like phenotypes in response to varying concentrations of curcumin, resveratrol, and paclitaxel (Taxol). Curcumin is a polyphenol isolated from the spice turmeric and has been examined for its effects on human cancer cells. Resveratrol, another polyphenol, is found in red wine and has been investigated for its effects on extending lifespan. Paclitaxel, a diterpene isolated from the Pacific yew, is an approved chemotherapy drug for the treatment of breast, ovarian, and lung cancers in humans. 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*.

8. ASSESSING THE GENETIC RELATIONSHIPS BETWEEN MAYFLY (*BAETIS*) POPULATIONS

Daniel Locker, Jacob Peterson, Laurie Furlong and Sara S. Tolsma
Northwestern College

As Midwestern prairie habitats were largely converted into an agricultural monoculture, their lotic systems were degraded through sedimentation and eutrophication. These changes created ecological islands' remnants of suitable habitat in large areas of degraded habitat. Populations restricted to these isolated patches of habitat can accumulate random genetic changes leading to genetic drift. *Baetis* mayflies may be particularly sensitive to such habitat degradation and isolation. They spend the majority of their life cycle as aquatic nymphs with narrow habitat requirements. Their adult dispersal capabilities are low, as they are weak fliers and this life stage is relatively short (few days). Therefore, we hypothesize that habitat loss and fragmentation in Iowa has created ecological islands of mayfly habitat. We believe these isolated groups of mayflies are experiencing genetic drift that can be detected by molecular genetics analysis. We are amplifying fragments of the mitochondrial cytochrome oxidase I (mtCOI) gene from mayflies collected within and between four different Northwest Iowa watersheds. We are cloning the fragments into pGEM-T vectors so that the mayfly mtCOI gene fragments can be sequenced. We predict that mayflies within a watershed will exhibit fewer genetic differences than mayflies in different watersheds.

ABSTRACTS BY SECTION

9. PRAIRIE IN A PETRI DISH

Delia Moran Portillo, Alex Paine and James Hampton
Buena Vista University

The prairie plants of Iowa are of particular interest as they have a 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. Despite their known and potential benefits, there has been relatively little work done establishing tissue culture lines of these beautiful and interesting organisms. Our research group has attempted to introduce tissue from various prairie plants into culture. We have included *Ratibida pinnata* (yellow cone-flower), *Andropogon gerardii* (big blue stem), *Asclepias incarnate* (swamp milkweed), *Asclepias tuberosa* (butterfly milkweed), and *Monarda fistulosa* (bergamot) as part of our culturing attempts. We have had varying degrees of success with *R. pinnata* and *A. incarnate* producing the most callus. We will also present the results of the treatment of these tissue cultures with the microtubule inhibitor, colchicine in an attempt to generate polyploid lines.

10. COMPARING THE RELATIVE EFFECTIVENESS OF HERBAL MEDICINE AND ANTIBIOTICS IN CONTROLLING GROWTH OF *BACILLUS CEREUS* AND *ESCHERICHIA COLI*

Nathan Reddick, Brittney Donn, Andrew Ohlrich and Brian A. Lenzmeier
Buena Vista University

The concept of herbal medicine is huge topic in today's society. Does the evidence support the hype? A series of different types of herbs were collected and analyzed for anti-microbial properties. This was done by collecting the extract from the herbs and mixing it with the bacteria. After incubation, the cultures were then plated to check and see if they were effective at killing the bacteria (bacteriocidal) or inhibiting the growth of the bacteria (bacteriostatic). Herbs exhibiting bacteriocidal properties were then plated once again using the disc diffusion assay method. The zone of inhibition given off by the bacteriocidal herbs were compared to the performance of antibiotics that are usually prescribed in today's medical practice.

11. INTRODUCING FLUORESCENCE INTO PETUNIA HYBRID

Amanda Roder, Allison Kirchgatter, Jessica Knutson and James Hampton
Buena Vista University

The Nobel Prize for Chemistry in 2008 was given to several scientists for their studies of the green fluorescent protein as a reporter system. This research has opened the doors to using fluorescent proteins on both the molecular and organismal levels. The purpose of our research is to study gene expression in plants, utilizing fluorescence as a reporter gene system. A plasmid was obtained that contains a 35S plant promoter driving the expression of CFP and YFP. Using *Petunia hybrida*, cultures have been prepared to initiate the growth of callus, undifferentiated plant cells. Those cell lines have been injected with DNA plasmid using an aerosol beam injector. The effectiveness of this novel transmission system is being evaluated.

12. AN ATTEMPT TO PREVENT TOOTH DECAY: NEUTRALIZING THE ACID PRODUCED BY BACTERIA IN THE MOUTH

Mysty Shaver and Brian A. Lenzmeier
Buena Vista University

The degradation of the calcium phosphate enamel of teeth is caused by an acidic environment. This is also known as tooth decay or the formation of cavities. Acid is produced through the fermentation of ingested and chemically produced sugars. This process is carried out by a wide variety of bacteria found in the human mouth. I am attempting to neutralize the acidic conditions created as a result of this process by using common biological buffers, such as potassium phosphate and tris. In using minimal growth medium with the pH indicator, phenol red, and varying concentrations of buffers I can monitor acid production both quantitatively, by pH, and qualitatively, by indicator color change. To each test tube of growth medium I added the sugar being studied. Mouth samples were taken using a sterile loop, dried, and then placed within the test tube. Preliminary research has revealed that the presence of a buffer yields less acidic environments, and the higher the concentration of that buffer the more neutral the pH. In

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this presentation I will present this data and will discuss future directions for this project.

13. ANALYSIS OF CANDIDATE GENES THAT SUPPRESS CHROMOSOME LOSS IN *SACCHAROMYCES CEREVISIAE* MUTANTS WITH DEFECTS IN CHROMOSOME TRANSMISSION ^{ISF}

Heidi Sleister, Naomi Adjei, Alyssa Ellis, Lanie Feigenbutz, Traci Gwinn, Jim Kolnik, Lindsey Miller, Neel Patel, Kevin Peterson, Alex Richardson, Christine Setsodi and Whitney Michaels

Drake University

Errors in the eukaryotic cell cycle and processes that maintain genome stability can result in abnormal chromosome number and structure (e.g., in humans—Down Syndrome, cancer). The common baker's yeast *S. cerevisiae* is a great model system for the analysis of chromosome transmission as yeast artificial chromosomes (YACs) can be lost or rearranged without harming the cell. In an effort to identify proteins important for chromosome transmission, yeast mutants that display increased loss of a YAC during cell division were generated. Suppressor analysis resulted in the isolation of both single and high copy yeast genomic plasmids that improve the chromosome loss defect in these mutants. Subsequent analysis revealed multiple candidate genes present within the suppressor plasmids. Each gene is being individually cloned and assayed for suppression of chromosome loss.

14. THE ROLE OF GLUTATHIONE PEROXIDASE AND CATALASE IN MEDIATING THE ANTIOXIDANT PROPERTIES OF PROLINE IN *SACCHAROMYCES CEREVISIAE*

Grant Turner, Cali Reiling and Brian A. Lenzmeier
Buena Vista University

Reactive oxygen species (ROS) are naturally generated through the process of creating energy for the body. In order for cells to survive, they must be able to process these ROS. It has been hypothesized that high levels of the amino acid proline helps protect cells from ROS. The exact mechanism for proline's putative antioxidant properties is currently not known. We hypothesize that proline

may work through either glutathione peroxidase (GPx) or catalase. These are enzymes capable of processing ROS like hydrogen peroxide. Using baker's yeast as a model research organism we are exposing cells to high levels of proline and monitoring its affect on the activity of GPx and catalase enzymes in cell-free extracts isolated from those cells. We will present our research findings and will outline future studies that will include research with other mutated forms of yeast to identify the exact cellular processes that mediate the antioxidant properties of proline.

15. BIOACTIVITY ASSAY OF BDNF AND GDNF SECRETED BY ENGINEERED MOUSE MESENCHYMAL STEM CELLS

Senyo Sefako Whyte, Eun-Ah Ye and Donald Sakaguchi
Iowa State University

Neurodegenerative diseases such as glaucoma are characterized by progressive cell death for which there is not yet a perfect remedy. To develop strategies of stem cell-based therapy for neurodegenerative ocular diseases, we studied engineered mesenchymal stem cells (MSCs), which would be a potent vehicle for delivering neurotrophic factors to the diseased retina. The mouse MSCs were transduced with lentiviral constructs which carry a gene for the expression of either brain-derived neurotrophic factor (BDNF) or glial cell-derived neurotrophic factor (GDNF). To investigate the bioactivity of BDNF and GDNF secreted by engineered mouse MSCs, we performed ex vivo culture using mouse dorsal root ganglia (DRGs) and retinas in the conditioned media collected from the MSCs. Immunocytochemistry was performed on the DRGs and retinas and their neurite outgrowth was analyzed with FeatureJ, a plug-in for the image processing program ImageJ.

There are still openings in the 2011 Saylorville Speakers Series schedule. Contact Craig Johnson (craig.johnson@uni.edu) for more information.

Cellular, Molecular & Microbiology Section

Oral Presentations

16. THE EFFECTS OF LAURICIDIN/GML ON TNF- α PRODUCTION IN MURINE MACROPHAGE CELLS^{BB}

Lindsey Legatt and Jeanne Minnerath
Saint Mary's University of Minnesota

Lauricidin, also known as glycerol monolaurate (GML), has been shown to exhibit antiviral, antibacterial, and antifungal properties. Research has also shown that Lauricidin/GML may influence cells of the immune system by modulating T lymphocyte proliferation in vitro and cytokine production in vivo. For instance, in vivo studies have shown that Lauricidin/GML decreases production of the pro-inflammatory cytokine, TNF- α , which plays a significant role in a variety of diseases. The purpose of the present study was to analyze the effects of Lauricidin/GML on TNF- α production in RAW264.7 murine macrophage cells. Briefly, lipopolysaccharide (LPS) stimulated RAW264.7 cells were incubated in the presence or absence of various doses of Lauricidin/GML. TNF- α production was measured using a sandwich enzyme linked immunosorbent assay (ELISA: R&D Systems, Minneapolis, MN). Results indicated that on a per cell basis, Lauricidin/GML did not significantly decrease TNF- α production by RAW264.7 cells at the concentrations tested. This would suggest that Lauricidin/GML may influence TNF- α producing cells other than macrophages. Future experiments will be completed examining the effects of Lauricidin/GML on other cells of the immune system. Furthering our understanding of Lauricidin/GML is important since this chemical is a promising treatment option for individuals suffering from a variety of infectious diseases.

17. SCOLEXIN DETECTION IN *MANDUCA SEXTA* LARVAE^{BB}

Nichole Clammer and Casey Finnerty
Saint Mary's University of Minnesota

Scolexin is a protein that initiates a clotting cascade in *Manduca sexta* following viral infection and/or bacterial, LPS or yeast injection. It is a member of the chymotrypsin family of serine proteinases. It is also the first protein known to be induced by baculovirus infection, and its induction by bacteria and fungi has also been demonstrated (Finnerty and Granados, 1997). Baculoviruses are being used as biological control agents, and in order to make them more effective it is important that the defenses against them be characterized. Because scolexin is induced by so many challenges, it has been suggested that scolexin is involved in the insect immune response, however such a role remains unproven. This research will be focused on determining whether or not scolexin transcripts can be detected in *Manduca sexta* larvae that have been challenged with bacterial infection. The results will confirm whether scolexin is synthesized de novo upon infection or if it is released from secretory vesicles via exocytosis upon infection. Once this is deduced, RNAi will be introduced into the insects to determine if scolexin expression results in greater *M. sexta* susceptibility to infection. Thus far, it is possible from recent results to conclude that scolexin has been induced in *M. sexta* hemolymph. With the use of RT-PCR, we hope to also identify scolexin from the mRNA extracted from *M. sexta* tissue samples.

18. SHINING A LIGHT ON THE EXPRESSION OF HETEROLOGOUS PROTEINS IN HYBRID *PHALAENOPSIS* AND *PETUNIA* HYBRID

Jessica Knutson and James Hampton
Buena Vista University

The Nobel Prize for Chemistry in 2008 was given to several scientists for their studies of the green fluorescent protein as a reporter system. This research has opened the doors to using GFP on both the molecular and organismal levels. The purpose of our research is to study gene expression in plants, utilizing fluorescence as a reporter gene system. We have been working with tissue culture and establishing the appropriate cell lines for *Petunia hybrida*

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and a hybrid of two species of *Phalaenopsis* from Madagascar. A plasmid was obtained that contains a 35S plant promoter driving expression of CFP and YFP. We have been working with this plasmid trying to insert it into *Petunia hybrida* and *Phalaenopsis* hybrid callus using a novel transformation system called the aerosol beam injector. These transgenic plants are predicted to fluoresce when bombarded with ultraviolet light and provide information about gene expression.

19. COMPETITION OF METHICILLIN-SUSCEPTIBLE ASYMPTOMATIC CARRIAGE *S. AUREUS* ISOLATES AND USA300, A METHICILLIN-RESISTANT STRAIN

Joshua Beutler, Michael Oetken and Michael O'Neal
Morningside College

In this study, asymptomatic carriage isolates of methicillin-susceptible *Staphylococcus aureus* were grown together with the methicillin-resistant strain, USA300, to determine which type of bacteria would display a growth advantage in the absence of antibiotics. Broths were inoculated with an equal number of each methicillin-susceptible strain and USA300. Serial dilutions were performed for each set of broths and were plated on TSA plates and TSA with ampicillin plates. Replica plating was used to confirm serial dilution results. Competition was continued for 3 passages. Results: 3 of 4 MSSA strains initially out-competed USA300 but showed fluctuation after the second passage. The 4th MSSA strain was the only strain to show a continual downward trend suggesting that USA300 had gained an advantage. When the MSSA:MRSA ratio is below one, antibiotics should not be used in order to allow MSSA bacteria to out-compete MRSA.

20. SUPPRESSION OF YEAST FILAMENTOUS GROWTH BY BORIC ACID

Martin Schmidt and Michael P. Boyer
Des Moines University

The pathogenic yeast *Candida albicans* can undergo a transition from unicellular to hyphal growth. This transition is triggered by a variety of environmental factors and contributes to the virulence of the organism. This study fol-

lows up on the observation that boric acid, an alternative remedy for the treatment of vaginal yeast infections, suppresses the transition to filamentous growth in *C. albicans*. Our data show that suppression of hyphal growth by boric acid occurs at concentrations well below the minimal inhibitory concentration and is thus not a manifestation of a general growth arrest. The inhibition of filamentous growth in both *C. albicans* and the model yeast *Saccharomyces cerevisiae* requires the activity of the yeast p38 MAPK homologue Hog1: Hog1 mutants of both organisms show excessive filamentous growth even in the presence of boric acid. The classic function of the Hog1 signaling cascade in yeast is the activation of glycerol synthesis in order to improve the survival of osmotic stress. Our data show that while the Hog1 signaling cascade is required for the survival of boric acid stress, the synthesis of glycerol is not. Screening of the yeast deletion collection has identified Hog1 targets other than glycerol synthesis enzymes that are required for boric acid tolerance, such as enzymes functioning in the glycolytic pathway and in the synthesis of trehalose. These and other data suggest that boric acid resistance depends on the ability to adjust carbohydrate energy metabolism. Furthermore, our data suggest that the efficacy of boric acid in the treatment of *Candida* infections is at least in part based on the Hog1-dependent suppression of filamentous growth.

21. DIGEORGE CRITICAL REGION 6 (DGCR6) INTERACTS WITH PROTEIN INTERACTING WITH C KINASE (PICK1) WHEN PICK 1 IS BOUND TO A PDZ DOMAIN BINDING PROTEIN

Erin DeBerry¹, Matthew Hakeman¹, Cassandra Larimer¹, Nicholas Gansemer², Joseph Zabner² and Alesia Hruska-Hageman¹
Mount Mercy University¹; University of Iowa²

PICK1 (Protein Interacting with C Kinase 1) is a protein that is found to help regulate proteins involved in learning, memory, axonal guidance and cancer. Most research on PICK1 has been focused on the PDZ domain which has been shown to interact with about 40 different proteins including AMPA receptors, ASICs, CAR, and Dopamine and Serotonin transporters. PICK1 also contains a BAR domain which has recently been shown to interact with the BAR

domain of ICA69 (Islet Cell Auto Antigen 69kDa) forming heterogenic complexes that regulate the targeting and surface expression of AMPA receptors at synapses. To learn more about the function of PICK1's BAR domain a Yeast Two-Hybrid Assay was performed to identify proteins that interact with this region. DGCR6 (DiGeorge Critical Region 6) was a protein identified in the assay to interact with the BAR region of PICK1. Earlier research done to further study the interaction between PICK1 and DGCR6 showed these two proteins interacted only in the presence of CAR, a protein that is known to bind to PICK1's PDZ domain. This data suggested that DGCR6 and PICK1 interact through a conformation change that occurs when another protein is bound to PICK1's PDZ domain. To test this interaction the PDZ domain of PICK1 was deleted and this shortened form of PICK1 (PICK1 109-415) and DGCR6 were co-transfected into COS-7 cells, stained using immunofluorescence, and viewed using confocal microscopy. This data not only showed that PICK1 (109-415) and DGCR6 interacted via PICK1's BAR domain, but that PICK1 (109-415) was expressed throughout the cell in a more punctuate pattern than full length PICK1. Deletions of the DGCR6 gene have been linked to DiGeorge syndrome and schizophrenia. The interaction between PICK1 and DGCR6 may be important in preventing these disorders from developing.

22. STRESS, ALCOHOL, AND DRUGS: EFFECTS ON THE LONGEVITY OF *CAENORHABDITIS ELEGANS*

Emily Nielsen, Sarah Larson and James Hampton
Buena Vista University

The nematode *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 has examined the changes in lifespan of adult and dauer worms due to various compounds either inducing or alleviating oxidative stress. We have also examined the effects on adult mutants with cancer-like phenotypes in response to varying concentrations of curcumin, resveratrol, and taxol. In addition to presenting our findings, we will also discuss the nature and advantages of using *C. elegans* as a model organism.

C hemistry Section

Posters

23. BEYOND OCTANITROCUBANE: ASSESSING THE EFFECTIVENESS OF THEORETICAL OCTANITRO C-8 COMPOUNDS AS HIGH ENERGY DENSITY MATERIALS (HEDMS):II

John A. Bumpus, Tom Hammond, Lauren Dougall, Zachary Hagedorn, Rhiana Harm, Erin Healy, Katie Henze, Alyssa Hickey, Alexander Hoffman, Janeth King, Amanda Klendworth, Carla Koch, Nicholas Luke, Derrick McAdams, Breanne Mumm, Ashley Navin, Britta Nelson, Stacey Reding, Colin Thomas and Venessa Zuetlau
University of Northern Iowa

This study is a continuation of ongoing research characterizing theoretical high energy density materials (HEDMs). HEDMs are used as high explosives and as propellants. Because of the expense and effort often required for the synthesis of new HEDMS, it is beneficial to be able to predict the properties of such compounds in order to identify promising candidates for continued investigation and dismiss those that are not likely to be appropriate for this purpose. P.E. Eaton's group pioneered the synthesis of cubane and octanitrocubane. As the name implies, cubane (C₈H₈) exists in the shape of a cube, having a C-H group at each corner. In octanitrocubane (ONC), the C-H groups are replaced by C-NO₂ groups. At one time, it was thought that even cubane would be impossible to synthesize or, at the least, would be very unstable due to its substantial ring strain. However, both cubane and ONC have been synthesized and well characterized by Eaton and his colleagues. Octanitrocubane is an excellent HEDM and is one of the model or standard compounds against which new HEDMs are compared. Our interests focus on the identification and computational characterization of theoretical octanitro C-8 HEDM compounds that have properties that are predicted to be comparable or even superior to those

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of octanitrocubane. Previously this laboratory identified and characterized four such compounds. In the present study six more octanitro C-8 compounds have been characterized with respect to their computed heat of formation values, oxygen balance, density, heat of detonation, heat of explosion, volume of gas produced upon explosion, explosive power and power index. These results, coupled with previous investigations suggest that octanitro C-8 compounds represent a relatively large family of target compounds that should be further explored with regard to their synthetic accessibility and subsequent usefulness as HEDMs.

E cology & Conservation Section

Posters

24. THE EFFECT OF BURN TIMING ON GRASSHOPPER AND GROUND BEETLE ASSEMBLAGES IN EARLY STAGE OF A RECONSTRUCTED TALLGRASS PRAIRIE

Anna Abney, Daryl Smith and Dave Williams
Tallgrass Prairie Center, University of Northern Iowa

Prescribed burning is a common management practice in prairie reconstructions but many entomologists are concerned about the impact of burning on insect populations. The effect of fire on insects has been studied on remnant prairies and other grasslands, but little research has been done on reconstructed prairies, especially in the first few years after planting when insects are colonizing the site. My study examines how spring and fall prescribed burns affect the species composition of grasshoppers and ground beetles in a recent prairie planting. The study area, located in the Cedar River Natural Resource Area in Black Hawk County, was formerly row crop. It was seeded to 16 native grasses and forbs in fall 2008. My research site was divided into a randomized two-block plot design with 18 plots. The treatments include a fall burn (October), spring burn (April), and a no-burn control, each replicated three times per block. In early October 2009, I

conducted preliminary sampling of the site to assess insect activity and sampling procedures; the two most abundant orders were Coleoptera (11.6%) and Orthoptera (13.3%). My hypotheses are as follows: insect species richness will increase over time on all plots; insect species richness will increase more on burned plots, with plots burned in the spring having the highest richness; abundance of ground beetles will increase on burned plots post-fire; and abundance of grasshoppers will decrease on burned plots post-fire. Preliminary results show that grasshopper abundance in June 2010 was significantly higher on both spring and fall burned plots than on control plots (fall: $p=0.014$; spring: $p=0.018$), but that abundance in September 2010 showed no difference. Ground beetle abundance showed no significant difference in June or September. Vegetative sampling was conducted in June 2010 and September 2010, and differences in June grasshopper abundance was strongly correlated to percent cover of bare ground after burning ($p=0.001$). Statistical analysis and species identification is ongoing.

25. SOUTHERN FLYING SQUIRRELS IN EASTERN IOWA: AN ECOLOGICAL ASSESSMENT

Tori M. Ballweg, Christine M. Grannis, Gerald L. Zuercher and David E. Koch
University of Dubuque

Southern flying squirrels, *Glaucomys volans*, are considered a species of *Special Concern* in Iowa. Within Iowa, their abundance is officially *Uncommon* and their population trend is *Unknown*. Although their reported distribution in Iowa includes all but the extreme northwest corner, there are relatively few records for the species within the state. As part of a pilot project, we documented a population of southern flying squirrels in Mines of Spain Recreation Area, a state park in Dubuque County, situated within the bluffs along the Mississippi River. Two transects were established along park trails. Ugglan multiple-capture traps were placed between 12 and 15 feet off the ground in large trees, baited with peanut butter, and checked each morning. We successfully captured and tagged 20 individuals (12 males and 8 females) and recaptured 10 individuals (8 males and 2 females), some as many as six times. While both recaptured females exhibited strong site

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fidelity, five males were captured on both transects which were approximately 1 km apart. Average daily movements by males were approximately seven-times greater than those by females. This difference needs further investigation as it seems to suggest that males utilize much larger areas than females. Our success in capturing and recapturing southern flying squirrels will be the basis for development of long-term monitoring and assessment of this species in eastern Iowa. In addition, we intend to further investigate movement patterns within the park and adjacent areas.

26. ESTIMATION OF WHITE-TAIL DEER DENSITY USING DIGITAL CAMERA TRAPS IN SIOUX CITY, IOWA

Joshua Beutler and William Pfau
Morningside College

The purpose of this study was to use digital camera traps to estimate the size of the white-tailed deer herd in the Loess Hills in Sioux City, Iowa. Beginning in January 2011, four camera traps were placed approximately .75 m above ground in a wooded section of Ravine Park in the southern portion of Sioux City. Deer density from camera trapping rate (3 photos/5 min.) was estimated from a model that required independent estimates of speed of movement and group size. Density from camera traps was compared to a true census of the deer herd. Accuracy of estimates and potential problems of using this method will be discussed.

27. EXPERIMENTAL POLLINATOR EXCLUSION IN LOW AND HIGH DENSITY STANDS OF *CHAMAECRISTA FASCICULATA* (PARTRIDGE PEA)

David Carter, Jacob Gaster, Heather Pagelkopf, Heidi Doty and Laurie Furlong
Northwestern College

Long-term persistence of native plant species in Iowa's fragmented tallgrass prairies is dependent upon several interacting factors. For outcrossing species, the lack of pollinators may limit seed set and genetic diversity. Small isolated populations may be most at risk of pollinator limitation if the collective floral display fails to attract ade-

quate numbers of pollinators. This field study addressed the effect of experimental pollinator exclusion on the seed set in high density and low density stands of a *buzz pollinated* native plant, *Chamaecrista fasciculata*. Exclusion was achieved by enclosing flowering stems in mesh bags before the flowers had opened. We manipulated the degree of exclusion by varying mesh size. Whenever possible, individual plants were subjected to multiple treatments. Following fruit set, legumes were removed from the plants and dry weights of the fruits or seeds were compared. We hypothesized that pollinator exclusion would reduce seed set, predicting an inverse relationship between seed set and degree of exclusion. In addition, we hypothesized that pollinator exclusion would have a greater effect in the high density stand. Our results did not support our hypotheses. Pollinator exclusion did not result in significant differences in seed set in the high density stand. In the low density stand, seed set was significantly higher in medium and small mesh treatments compared to the control (no exclusion). These results were surprising given reports that the partridge pea is dependent upon buzz pollination. However, when observing the flowers, we noted that pollen-covered thrips were frequently present. The thrips were observed crawling in and out of the poricidal anthers of the flowers. These small insects would not have been excluded by our mesh bags, and may have been trapped within them. It is possible that thrips are an overlooked and important pollinator of *Chamaecrista fasciculata*.

28. A PRELIMINARY ANALYSIS OF THE RELATIONSHIP BETWEEN REMNANT PRAIRIE-PATCH SIZE AND INSECT DIVERSITY

Daniel D. Goodding¹, William H. Heyborne² and James C. Stroh²
University of Texas at Tyler¹; Morningside College²

Standardized samples of insects were collected via sweep net from five remnant prairie patches in the northern Loess Hills of Iowa. Collected specimens were identified to morphospecies in order to analyze the relationship between patch-size and diversity. A positive correlation between patch size and diversity was hypothesized. However, the validity of this hypothesis was found to be depend-

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ent on the measure of diversity used. Species richness as well as Shannon's and Simpson's biodiversity indices were used to represent diversity. Herein are described the findings from this study as well as possible implications for prairie management.

29. TEMPORAL VARIATION IN RESPONSES TO CALL-BROADCASTS OF SECRETIVE MARSH-BIRDS IN IOWA

Tyler M. Harms and Stephen J. Dinsmore
Iowa State University

Call-broadcast surveys are frequently used to elicit responses of secretive marsh-birds. However, little is known about how detection rates differ by season and time of day. The objective of this study was to compare response rates to call-broadcast surveys for four species of marsh-birds as a function of (a) time of day and (b) time of season. We conducted call-broadcast surveys at wetlands throughout Iowa from 15 May-13 June 2010 (early season) and from 15 June-10 July 2010 (late season). We conducted surveys in the early morning and late evening in accordance with the North American Marsh Bird Monitoring Protocol. We surveyed 136 points at 56 wetlands and visited each point on a consecutive morning and evening both early and late season. We used generalized linear mixed-effects models to examine the effects of time of season, time of day, and wetland size on the number of detections for four species; Pied-billed Grebe, Least Bittern, Virginia Rail, and Sora. We also examined the above effects on all rails pooled and all eight species pooled. We found strong ($P < 0.05$) effects on the number of detections for Pied-billed Grebe (time of season, time of day, and wetland size); Sora, Virginia Rail, all rails, and all species had an effect of time of season only. Understanding seasonal and time-of-day differences in detection rates, as well as area dependence of marsh-birds will aid in the development of an effective monitoring protocol by allowing researchers to maximize detection probabilities of target species.

Do you know of a corporation that should be an Academy Corporate member? Send suggestions to Craig Johnson at craig.johnson@uni.edu.

30. RE-EVALUATING TEMPORAL SPACING IN INSECT SAMPLING REGIMES VIA TIMES SCALE CALCULUS^{ISF}

Stephen Henrich, Jill Jessee, Blaise Mikels, Jean Mullen, Heidi Berger and Clinton K. Meyer
Simpson College

Development of poikilotherms, such as insects, is known to be highly dependent on temperature fluctuations rather than strictly on the passage of time. Due to temporal temperature changes over the growing season, sampling at regular time intervals may incorrectly estimate population parameters. This research has assessed standard sampling regimes in insects, which are typically evenly spaced temporally. Our hypothesis was that sampling with evenly spaced time intervals skews resultant population growth estimates of livestock pest flies in Iowa. Field data were collected by collecting sticky traps weekly at several different locations on horse and dairy farms. We analyzed our data by employing time scales calculus to construct mathematical models of exponential growth. Time scales calculus allows for discrete analysis of variable temporally sampled data. Our model of constant graininess (for constant degree day interval sampling) allows us to test the direct effects of possible sampling regimes upon consequential population parameter estimates. This approach may lead to the development of novel sampling regimes to rectify the misrepresentation of population dynamics observed in temporally sampled data.

31. IDENTIFYING GROUND NEST PREDATORS

Matt Johnston, Derek Steele and Aaron Haines
Upper Iowa University

Nest predation is a major cause of mortality in ground nesting birds. Many animal taxa have been identified as nest predators. The objective of this study was to correlate images of identified nest predators using remote cameras to their predation patterns left at nest sites. Our study areas were located in Fayette County, Iowa. In each study area we placed artificial nests next to remote trail cameras for monitoring. Each nest was checked daily to identify evidence of a predation event. Once a predation event had occurred, the remains of the nests were analyzed for damage and then cataloged. We confidently

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identified the nest predation patterns of 3 nest predators: American crows (*Corvus brachyrhynchos*), northern raccoon (*Procyon lotor*) and Virginia opossum (*Didelphis virginiana*). Evidence to suggest a predation event by a crow included no evidence left behind, or a nest missing all of its eggs. Alternatively, we found many cases where crows did leave evidence in the form of eggs with small punctures (1/2' x 1/2') on the egg and the contents of the egg emptied. We found that northern raccoons would pick up eggs and bite the top off of the egg and feed on the inside in a cup like fashion. Thus, egg remains from a raccoon predation event included eggs with one severed half and remnant pieces of the other half of the egg spread in the nest. The Virginia opossum was a bit of a messy nest predator; it would simply crush the egg and lap up the egg contents from the ground. In this study we found that nest predators can potentially be identified by looking at the evidence that is left behind after a nest predation event.

32. SURVIVABILITY RATES OF ZOOPLANKTON IN A PASSIVE DISPERSAL SIMULATION

Cassandra Klostermann, Lucas Prater, Tsion Lemma and Johanna Foster
Wartburg College

Zooplankton, small algae-eating animals, are found in aquatic ecosystems all over the world, but cannot travel without assistance. One mechanism proposed for their dispersal is external attachment to migrating waterfowl when the birds move between aquatic ecosystems. External dispersal of zooplankton on waterfowl has been assumed for decades, yet limited research exists for this method. Zooplankton dispersal is important to understand because these small algae-eaters interact within the food web of existing plants and animals in a given aquatic environment and thus might affect biodiversity levels. Our experiment examined the relationship of living zooplankton and waterfowl via lab and field simulations. Domestic geese served as model organisms for waterfowl and lab-cultured *Daphnia magna* served as model organisms for zooplankton. In the lab portion, we exposed feathers in an aquarium of *D. magna* for a period of two minutes and examined the feathers under a dissecting microscope to

determine if attachment occurred. For the field trials, we exposed a flock of domestic geese to a known number of zooplankton in a tub of water for 30 seconds. After 24 hours, we returned to the farm to simultaneously brush and pour water over the feathers to collect the attached zooplankton. Preliminary results showed that the attachment rate to geese feathers was low. It appeared that while waterfowl can carry zooplankton on their feathers, they do not play a central role in their dispersal. Many zooplankton produce ephippia, small structures with eggs, which can be dispersed via wind. The next step will be to determine if waterfowl play a significant role in the dispersal of zooplankton ephippia.

33. POTENTIAL EFFECTS OF PHOSPHATE LEVELS ON ODONATA DIVERSITY IN A NORTHWEST IOWA WETLAND LOCATED IN THE RACCOON RIVER WATERSHED

Elizabeth Allean McIntyre¹, Todd Allan Wical² and Melinda A. Coogan¹
Buena Vista University¹; Des Moines University²

As an important indicator of wetland system health, maintaining Odonata diversity in wetlands found within agricultural environments requires ongoing studies investigating various environmental parameters such as habitat modification, pesticide contamination, and nutrient concentrations. This spatial study investigated fall 2010 phosphorus concentration levels and the potential effects on Odonata diversity of Blackhawk Lake Wetland as well as two sites on the Raccoon River located equal distance above and below the wetland. Within each system, phosphorus levels, pH, conductivity, DO, and temperature assessments were conducted during the months of October and November 2010. During the summer months of 2008 collections of Odonata were recorded and assessed through Shannon Diversity calculations. Results indicated the highest average phosphate level (15 ppm) and the lowest Odonata diversity level (1.33) were found within the Black Hawk Lake Wetland waters. The Raccoon River site results showed the same average phosphate levels (10 ppm), with the upstream site resulting in a diversity level of 1.75 and the downstream Whiterock site resulting in a diversity level of 2.40. Spring 2011 water assessments of phosphate levels will be conducted, but our preliminary results

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show a trend of lower Odonata diversity within waters expressing higher phosphate levels.

34. DRINKING IN THE RAIN: A COMPARATIVE STUDY^{BAB}

Jennifer Nieland
Central College

Drinking water in Iowa usually comes from two places: ground and surface water systems. Most Iowans have not considered a third option: Rain water. Globally rain water is more widely used but in the Midwest United State it is often a foreign concept, especially for drinking purposes. Using sources such as the Iowa Department of Natural Resources and other public information providers this research compiles and discusses some basic water information and statistics concerning the hazards and benefits of current water supplies versus using rain water as a source of drinking water. Since future ground and surface water supplies can and may be jeopardized, by pollution, over use and other problems, rain water is a good supplement to our existing systems but not a replacement. Impurities such as sulfuric acid and particulates are fairly average in our rain water collection samples and do not have any harmful effects in small quantities. So long as proper storage and filtration systems are implemented rain water is safe from harmful bacteria growth and most major harmful contaminants. Drinking rain water in Iowa is an underused resource that could reduce run-off and become a viable resource for Iowa in years to come.

35. THE EFFECTS OF EUROPEAN BUCKTHORN (*RHAMNUS CATHARTICA*) ON SOIL PROPERTIES IN A RIPARIAN FOREST

Olivia Norman, Todd Tracy, Sara Burmakow, Heather Craven and Amber Matilla
Northwestern College

This study explored the effects of the invasive shrub European buckthorn (*Rhamnus cathartica*) on soil properties in Northwestern College's riparian forest near Alton, Iowa. We tested moisture, carbon, phosphate, and nitrogen content of soil samples collected in early November from the center of each of 15 treatment plots (in which buckthorn

shrubs have been removed) and 15 control plots (in which buckthorn shrubs were left standing). In control plots, we found a significant direct relationship between buckthorn density and soil nitrogen levels and a significant inverse relationship between buckthorn density and soil phosphorus levels. These findings suggest that buckthorn alters soil nutrient levels. However, we found no significant differences in phosphorus and nitrogen levels between treatment and control plots, suggesting that the perceived relationship between buckthorn density and soil nutrient levels could be an artifact of an environmental gradient unrelated to buckthorn density. We propose that long-term soil testing at various times of year will enable us to determine more conclusively whether buckthorn is altering soil properties in Northwestern College's forest.

36. GENETIC STRUCTURE OF CONTIGUOUS BOBCAT (*LYNX RUFUS*) POPULATIONS IN OREGON^{ISF}

Dawn Reding¹, Carolyn Carter², Anne Bronikowski¹ and William Clark¹
Iowa State University¹; Clinton High School²

Knowledge of population structure is vital for the management and conservation of wildlife, but defining populations is challenging for widespread, mobile species. Bobcats are found throughout the state of Oregon and have been subdivided into two subspecies, one on either side of the Cascade Range. It is unclear whether such classification actually reflects the true population structure. Here, we use genetic data to test whether bobcats in Oregon represent one single panmictic population or are subdivided by the Cascade Range into two genetically discernible populations. We collected 250 samples from 12 districts located throughout the state and analyzed the samples using 15 microsatellite markers and 1 KB mtDNA sequence data. Pairwise F_{ST} estimates ranged from 0-0.085 based on microsatellites and 0-0.436 for mtDNA, with the most significant genetic differences occurring between sampling districts on different sides of the Cascades. We found weak but significant structure between the two regions ($F_{CT} = 0.015$ for microsatellites and 0.128 for mtDNA). Bayesian clustering analysis further supported a scenario of two populations, one on either side of the Cascades. Overall, our results suggest that despite their mobility and broad

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range, bobcats in Oregon do not form a single population. The degree of genetic differentiation, however, was surprisingly low given the taxonomic distinction of two subspecies in the state. From a management perspective, our results on genetic structure support current policy, which regulates harvest on the two subspecies separately, since the two regions generally reflect the actual structure of the population.

37. CONTROL OF *ALLIARIA PETIOLATA* AND SURVEY OF NATIVE FLORA AT THE YELLOW RIVER FOREST

Laurie Remmen¹, Jennifer Stoffel¹ and Richard Kittelson²
Upper Iowa University¹; Northeast Iowa Resource Conservation and Development²

Alliaria petiolata (M. Bieb.) Cavara & Grande (garlic mustard) is an invasive species which crowds out native species, limiting biodiversity. Studies have shown that Roundup, Rodeo and corn gluten meal (CGM) have herbicidal effects on garlic mustard. The object of this experiment was to determine if corn gluten meal, Roundup, and Rodeo would kill this season's adult stage plants and reduce the concentration of next season's garlic mustard rosettes compared to control plots. The study took place at the Yellow River Forest in Allamakee County, Iowa. Four quadrats were used per treatment type and control. The study site was surveyed both pre- and post-herbicide application to determine the percent cover of garlic mustard present, as well as species diversity. Preliminary results show that both Roundup and Rodeo are highly effective at killing established garlic mustard plants while corn gluten meal had little effect on established plants, and that garlic mustard plants quickly re-established after treatment with Roundup and Rodeo, while plots treated with corn gluten meal experienced less re-emergence after seasonal senescence. Species diversity shows little change after one treatment.

38. THE EFFECT OF TALLGRASS PRAIRIE SPECIES COMPOSITION ON ABOVE GROUND BIOMASS PRODUCTION

Molly Schlumbohm, Daryl Smith and Dave Williams
Tallgrass Prairie Center, University of Northern Iowa

Despite growing demand for alternative fuels, little research has focused on the potential of utilizing mixed stands of tallgrass prairie species for energy production. A recent study by Tilman (et al. 2006) suggests that increasing species diversity of the stand increases above ground biomass. In 2008, the Tallgrass Prairie Center at the University of Northern Iowa initiated a five year research project to determine if Tilman's results could be applied at a field level scale, with selected species, and no fertilizer or soil modification. In spring 2009, ninety-eight acres within the Cedar River Natural Resource Area in Black Hawk County, Iowa were seeded with 4 seed mixes: a monoculture stand of switchgrass (control), a mix of 5 warm-season grasses (including switchgrass), a biomass mix of 16 species (including previous 5 species plus additional 11 species), and a 32 species prairie mix (including the previous 16 species plus additional 16 species). The four treatments were planted in three different soil types. Biomass sampling conducted fall 2010 indicates that soil type plays a significant role in biomass production with well-drained loam producing the most total biomass (8875.9 kg/ha) and poorly drained clay loam (5429.3 kg/ha) and excessively drained sandy loam (4766.7 kg/ha) respectively. In addition, an emerging trend indicates total biomass production increases with increasing species richness among treatments during the second growing season, with switchgrass averaging 5333.8 kg/ha, the 5 warm-season grasses averaging 6339.3 kg/ha, the biomass mix averaging 6403.8 kg/ha, and the prairie mix treatments averaging 7352.3 kg/ha. Findings indicate that weed biomass decreased with an increase in species richness. This trend is encouraging for farmers who wish to control weeds with minimal input. The results from the second growing season indicate that prairie biomass has potential as an alternative energy source.

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39. REGIONAL ASSESSMENT OF RECOVERY IN PLATTE RIVER WETLANDS USING SOIL AND PLANT INDICATORS

Phillip A. Seiwert, Anna E. Statz, Jakob T. Woods, Amber M. Walker and Clinton K. Meyer
Simpson College

Wetlands provide many ecosystem benefits including flood control, improvement of water quality, removal of nutrients, and recharge of groundwater. Recent appreciation for these benefits and large-scale destruction of wetlands for agricultural practices and urban expansion have resulted in increased restoration efforts. Although many conservation organizations in the Platte River valley have spent substantial time and monetary resources to take cropland out of production and restore it to wet meadow systems, evaluation of success has been limited. We measured several indicators of success (organic matter, soil bulk density, plant wetland indicator status, plant diversity, and plant productivity) in a chronosequence of 17 restored wetlands ranging from one to 19 years old and in five natural wetlands to assess regional patterns in recovery. We tested for significant changes in these indicators over time using regression techniques. Bulk density showed significant recovery in the wettest habitats (sloughs; $p=0.019$), and soil organic matter showed significant recovery in both sloughs ($p=0.002$) and higher elevation transects (margins; $p=0.034$) across the chronosequence. Results of this study suggest that although recovery is occurring at a regional level, rates are highly dependent on wetland hydrology (e.g., sloughs vs. margins). We hope these indicators will provide a comprehensive assessment of restoration recovery to date in the Platte region and will be used to help improve outcomes in future restoration efforts.

40. GPS TRACKING OF RING-NECKED PHEASANTS: A PILOT PROJECT

Derek Steele, Mark Brown, Kiel Middleswart and Aaron Haines
Upper Iowa University

The use of Global Positioning System (GPS) telemetry to monitor the spatial movements of wildlife has been increasing in popularity for the last two decades. Benefits of GPS telemetry include increased precision and reduced

sampling bias in location estimation, increased ability to monitor wide-ranging species, as well as increased insights into climate-movement and habitat-movement. Only a few studies have used GPS technology to monitor the spatial movements of game birds. The objective of this pilot project was to report on the performance GPS collars fitted to a ring-necked pheasant (*Phasianus colchicus*) in Fayette County, Iowa. We used the Quantum 4000 enhanced GPS unit from Telemetry Solutions to take a location every 5 to 15 minutes to monitor the spatial movements of ring-necked pheasants. Based on our preliminary data, we believe that GPS telemetry can be used to conduct research with male ring-necked pheasants.

41. RESTORATION OF AN OAK WOODLAND IN NORTH-EASTERN IOWA

Kimberly Stocks, Jason Hagemeyer, Max Molzahn, Eric Baack, Beth Lynch and Kirk Larsen
Luther College

Over the last 150 years, Iowa's oak woodlands and savannas have seen dramatic changes in tree density and species composition. Relatively little research has been published on restoration of these communities. In particular, there are varying reports of the role of the seed bank in response to clearing and different fire regimes. We describe the experimental design to address restoration succession. The restored oak woodland was cleared of tree species other than oak and subject to one of three treatments: burned annually, burned every other year, and no burn. In addition, there are two control treatments, in which there is no burning and tree species were not cleared. One of the control treatments is located to the north of the woodland and the other is located to the south. In 2010, six transects were placed in each of the treatments. 147 plots were surveyed for understory plant species and relative abundance. The study will be completed in 2015.

42. TEMPERATURE SAMPLING IN DENS OF NORTH AMERICAN BADGER, *TAXIDEA TAXUS*

Andrew Walsh and Richard Lampe
Buena Vista University

The North American badger (*Taxidea taxus*) constructs burrows in various locations. Many burrows are found in road ditches or fence lines. During three months in autumn 2010, we sampled the burrow temperatures in three south-facing burrows and compared them with ambient temperatures found near burrow entrances. We used HOBO H8 Pro Series Data Loggers to log the temperatures and placed these devices inside the burrow by using a remote control vehicle (1/24 M1a2 Abrams Tank, VS Tanks). We found that the temperature within these burrows varied over a smaller range and remained warmer than the outside temperature. In one instance, we observed an air temperature of 0.73°C while the temperature inside the burrow was 7.03°C.

telemetry, and the physiological costs of different habitats with biophysical models. These results are imported into a GIS for mapping and analysis. Occupancy for both species was ~90% in 2008 and ~85% in 2009. Based on the movements of 5 frogs and 18 toads from April through October 2009, toads traveled an average distance of 603.8 m (range = 58-2943 m) from their breeding ponds, while frogs averaged 187.4 m (range = 44-654 m). Frogs did not leave wetlands or surrounding prairies, whereas some toads used croplands extensively later in the season. Seasonal variation in physiological costs among habitats may explain some of these differences. These results will help us understand how distance and different land cover features on agricultural landscapes facilitate the movement of amphibians among restored wetlands.

44. RESPONSE OF A YELLOW MUD TURTLE (*KINOSTERNON FLAVESCENS*) COMMUNITY TO HABITAT CHANGE: MANAGEMENT IMPLICATIONS FOR A NATURE PRESERVE

Neil P. Bernstein¹ and James L. Christiansen²
Mount Mercy University¹; Drake University²

Yellow mud turtles (*Kinosternon flavescens*) have been studied in and around a nature preserve near Muscatine, Iowa for over three decades. The deep sand prairie habitat, unusual for Iowa, incurred a variety of anthropogenic disturbances since the 19th century; however, the area has been managed for natural habitat for the last 40 years, first by private hunt club (1970s) and later as a private conservation area (late 1970s to the present). The surrounding landscape either continues to suffer a variety of anthropogenic disturbances or was abandoned following disturbances during the twentieth century. Recent survey data for yellow mud turtles, an Iowa endangered species, were compared with past surveys to determine efficacy of management practices and effects of habitat alteration on the species. Because yellow mud turtles require wetlands in spring for hydration, feeding, and mating, we specifically focused on impacts and management of former oxbow habitats once connected to the Mississippi River. We conclude that wetlands outside the preserve no longer contain populations of yellow mud turtles. Causes of decline include a history of severe environmental disturbance

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Oral Presentations

43. RESPONSE OF AMPHIBIANS TO RESTORED WETLANDS ON AN AGRICULTURAL LANDSCAPE: PRELIMINARY RESULTS

Paul E. Bartelt¹ and Robert W. Klaver²
Waldorf College¹; United States Geological Survey, Earth Resources Observation and Science Center²

How do amphibians respond to the restoration of thousands of acres of wetlands scattered across an agricultural landscape? We are measuring occupancy and movements of Northern leopard frogs (*Rana pipiens*) and American toads (*Anaxyrus americanus*) among 22 wetland restoration sites in Winnebago County, Iowa. We are measuring occupancy with multiple surveys and program MARK, general dispersal patterns through mark/recapture and genetic analysis, detailed movements of individuals with radio-

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in addition to perpetual populations of permanent water-adapted aquatic turtles (e.g., *Chrysemys picta*) and predatory fishes that either compete for food with yellow mud turtles or prey upon juveniles. Our studies validate the necessity of wetlands that are shallow enough for aquatic turtle and fish winterkills but deep enough to yearly satisfy spring hydration and feeding requirements for yellow mud turtles.

45. USE OF AN ARTIFICIAL HABITAT BY RACERUNNERS (*ASPIDOSCELIS SEXLINEATA*)^{BBB}

Michelle Gossen and Phil Cochran
Saint Mary's University of Minnesota

The racerunner is one of the few lizard species that is found in Minnesota. It is considered a species of greatest conservation need, and it typically occurs in remnant patches of prairie habitat on southern or southwest-facing bluff slopes in the southeastern part of the state. However, a population of racerunners occurs along an elevated dike road at Prairie Island Park in Winona, Minnesota. An assessment of racerunner use of this habitat took place during the summer and early fall on warm days when racerunners were most likely to be active. Paired random 50-meter transects revealed that racerunners were found along a distance of about 3 kilometers on the southern side of the road and about 1 kilometer on the northern side. The mean number of racerunners per transect was significantly greater on the southern side of the road. Paired measurements of substrate temperature revealed that the southern side of the road was significantly warmer than the northern side. However, the southern side consisted of open sandy habitat while the northern side was primarily rocky rubble, and it is possible that racerunners were easier to detect on the southern side. Racerunners were observed in transects that ranged from 2 meters to 13 meters from the edge of the road, and mean distances from the southern edge (7.23 meters) and the northern edge (5.50 meters) were not significantly different. This study has shown that the dike road provides a substantial amount of habitat that is used by racerunners. A further goal is to use the transect data to estimate the racerunner population size.

46. DEPTH DISTRIBUTION OF COMMON *HOLOTHURIA MEXICANA* (DONKEY DUNG SEA CUCUMBER) VERSUS ITS ELONGATED LENGTH

Timothy L Hintze
Central College

Sea cucumbers have increasingly become the target of harvesting in the Caribbean, especially due to changes with harvesting opportunities drying up in southeastern Asia. As such, data was collected on the length and depth of occurrence of *Holothuria mexicana* (donkey dung sea cucumber). Each individual's elongated length was also recorded to see if there was a correlation between depth found and the specimen's size. All measurements were done on Wee Wee Caye located on the lagoon side of the Belizean portion of the Mesoamerican barrier reef system. The elongated length and depth were recorded for each of three transects of approximately equal area on the leeward side of the Key during two days between 14:00 and 16:30 hrs. Results showed a relatively consistent length for all individuals, regardless of the depth found. The distribution tended to favor the depth around 2 m depth. For this study evidence of juveniles in the area seemed to be limited. It would be important to note that although all individuals seemed homogenized in their distribution, with the lack of juveniles it would be unwise to consider any form of fishing until age and sexual maturity are monitored.

47. BY THE NUMBERS: HOW IS RECOVERY DEFINED BY THE U.S. ENDANGERED SPECIES ACT?

Maile Neel¹, Allison Leidner¹, Aaron Haines², Dale Goble³
and J. Michael Scott³
University of Maryland¹; Upper Iowa University²; University of Idaho³

Nearly forty years after passage of the U.S. Endangered Species Act, recovery prospects remain dim because they are too severely imperiled by the time they receive the Act's protection and because abundances required for recovery fail to provide high probability of persistence. Lack of sufficient data for setting recovery objectives also remains a barrier. Delisting is considered possible for only 74% of the 1,173 conservation units (listed species, sub-

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species and distinct populations with recovery plans), 92% of threatened and 69% of endangered units. The median number of populations required for delisting (8) was at or below historical abundances for 64% of units and at or below abundances at listing for 37% of units. The number of individuals required for recovery (median=2,400) exceeded abundances at listing for 93% of conservation units but most were below levels considered necessary for long-term persistence and evolutionary capacity especially in a changing environment.

48. CLIMATE CHANGE IMPACTS ON IOWA'S FLORA AND FAUNA: AN INITIAL ASSESSMENT

Laura L. Jackson and Peter B. Berendzen
University of Northern Iowa

Iowa climate data reveal increases in winter temperatures, longer growing seasons, increasing precipitation, and more extreme precipitation events. All are consistent with models of climate change in response to increasing greenhouse gasses. We reviewed published research on climate impacts relevant to Iowa in order to satisfy legislation passed by the Iowa General Assembly in 2009. Studies from the US and Europe report earlier spring arrival for many migratory songbirds and earlier appearance of spring wildflowers, with an average advance of 6.1 days per decade. The state endangered wood turtle *Glyptemys insculpta* experiences high nest mortality due to mid-summer flooding, which has increasing in recent years. Climate envelope models predict reductions in coldwater fish such as trout and smallmouth bass, and increases in warm-water fish. Waterfowl breeding areas in the prairie pothole region are predicted to contract from west to east. Specific predictions of regional increase or extirpation are difficult, however, due to multiple interactions among species. We suggest a role for the Ecology and Conservation Section of the Iowa Academy of Science in measuring biological impacts of climate change.

49. IMPACTS OF GOAT BROWSING ON MICROCLIMATES AND PHOTOSYNTHETIC RATES IN A SAVANNA RESTORATION

Johanna Desprez and Thomas Rosburg
Drake University

Research on oak savanna restoration has been underway at Chichaqua Bottoms Greenbelt in Polk County, Iowa since 2006. The project is investigating an innovative approach, using goat browsing to control woody growth. Baseline data on plant community composition and structure was collected in 2006 prior to mechanical removal of woody plants in late 2006 and 2007. Vegetation data was collected again in 2008 prior to the beginning of goat browsing. One of three treatments *control*, *cut*, or *cut and browse* by goats is assigned to eight research plots. The microclimates, light environments and plant photosynthetic rates associated with the treatment plots were investigated in 2010. Campbell Dataloggers were used to measure light, wind speed, air and soil temperature, relative humidity and soil moisture over three day periods in mid-summer and fall. A LiCor line quantum sensor was used to measure light levels on the plots, both above the herbaceous layer and on the ground surface. A Ciras-1 IRGA was used to measure carbon exchange rates of six plant species on four of the plots. It was found that the goats were having a positive effect in promoting a savanna environment with generally increased light, warmer temperatures, lower relative humidity and higher wind on the plots browsed by goats. Analysis of the photosynthetic data is underway and will be presented. Frequent flooding during the 2010 field season limited data collection; more replication is planned for 2011.

50. AVIAN COLONIZATION DURING EARLY ESTABLISHMENT IN A PRAIRIE BIOFUEL PROJECT

Jim Mason and Mark C. Myers
University of Northern Iowa

The University of Northern Iowa's Tallgrass Prairie Center is investigating the feasibility of using biomass harvested from diverse plantings of native prairie vegetation as a sustainable biofuel. A major objective of this research is to determine optimal methods for managing prairie vegeta-

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tion while maintaining high quality habitat for native wildlife. In 2009, a Black Hawk County site previously managed for row crop production and situated on three soil types was seeded with four different treatments of native vegetation ranging from a switchgrass monoculture to a diverse 32-species mix of grasses, forbs and sedges. We used visual line transect surveys to assess avian colonization of the site from the time of planting through August 2010. Avian use of the site was limited during the 2009 breeding season; however, sixteen bird species were frequently recorded in the plots during fall 2009 and spring 2010 migrations. Fall migrating bird abundance and richness were significantly greater in native vegetation compared to adjacent harvested corn fields. During the 2010 breeding season, we observed significantly greater avian abundance, richness and diversity in more diverse vegetative communities. Avian community structure also varied significantly between the treatments and soil types.

51. BUTTERFLY RESPONSE TO FLORAL RESOURCES DURING EARLY ESTABLISHMENT AT A HETEROGENEOUS PRAIRIE BIOMASS PRODUCTION SITE

Mark C. Myers, Ben Hokschi and Jim Mason
University of Northern Iowa

In the Midwestern USA, current biofuel production systems rely on high input monoculture crops that do little to support biodiversity. The University of Northern Iowa's Tallgrass Prairie Center is investigating the feasibility of cultivating and harvesting diverse mixes of native prairie vegetation for use as a sustainable biofuel in a manner that also conserves biodiversity and protects soil and water resources. In 2009, we established 48 research plots on three soil types at an Iowa site with a uniform history of row crop production. We seeded each plot with one of four treatments of native prairie vegetation: (a) switchgrass monoculture, (b) warm-season grass mix (5 grass species), (c) biomass mix (16 species of grasses and forbs), or (d) prairie mix (32 species of grasses and forbs). In 2010, we measured vegetation characteristics and studied butterfly use of the plots to investigate the hypothesis that more diverse plant communities would support a greater abundance and diversity of butterflies. Habitat characteristics varied significantly among

the plots by treatment and soil type, and butterflies responded rapidly to variation in floral abundance and richness. Averaged over the entire growing season, butterflies were six times more abundant and twice as species rich in the biomass and prairie mix plots compared to the warm-season grass and switchgrass plots. However, there were no differences in butterfly abundance, richness, or community composition between the biomass and prairie mix plots. Our results suggest that implementation of biomass production using diverse mixes of native prairie vegetation on marginal lands could have positive effects on the maintenance of biodiversity in agricultural landscapes.

52. COMPARISON OF ORGANIC AND CONVENTIONAL AGRICULTURE SYSTEM EFFECTS ON SOIL QUALITY

Chris James Pelzer, Mahdi Al-Kaisi and Kathleen Delate
Iowa State University

Grain and vegetable crop agriculture production has a very prominent role in Iowa's economy, accounting for 22% of its gross daily product. Additionally, approximately 76% of Iowa's land area is used for agriculture. For these reasons alone, agriculture systems have a decisive role in Iowa's soil, air, and water quality. Recently, interest from farmers in organic agricultural systems has increased due to enhanced market potential, reduction of production input costs, and the improvement of soil by reducing soil erosion, minimized nutrient leaching, and building of soil quality. In Iowa alone there has been a 37% growth in the number of dedicated organic cropland acres since 2000. As a result, comparisons between organic and conventional agriculture systems are needed to assess potential impacts on environmental quality. This study will examine the effect of both systems on soil quality and greenhouse gas emissions (CO_2 , CH_4 , N_2O , and NH_3). The study will also determine total carbon and nitrogen budgets and investigate soil quality indicators such as bulk density, soil aggregate stability, and soil microbial biomass to compare the effects of conventional and organic cropping systems. Ultimately, the goal of this study is to compare and give further insight about the impacts of conventional and organic agriculture on soil, air, and water quality.

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53. LOSS OF MILKWEEDS IN CORN AND SOYBEAN FIELDS DUE TO GLYPHOSATE HERBICIDE USE: POTENTIAL EFFECT ON THE MONARCH BUTTERFLY POPULATION

John M. Pleasants¹ and Karen Oberhauser²
Iowa State University¹; University of Minnesota²

Monarch butterflies (*Danaus plexippus* L.) in the Midwest have been shown to heavily use milkweeds in corn and soybean fields. Over the last decade there has been an increased use of glyphosate herbicide in these fields in conjunction with the increased use of glyphosate-tolerant crops. An Iowa study has shown that over the last decade there has been a 90% reduction in milkweeds in agricultural fields. Based on Iowa land use data for milkweed habitats such as roadsides, CRP (Conservation Reserve Program) land, pastures, and corn and soybean fields and using milkweed density information for these habitats it is estimated that over the last decade there has been a 39% reduction in the amount of milkweed on the Iowa landscape. The potential resource loss to monarchs could be much greater than this because monarchs lay 3.5 times as many eggs on milkweeds in agricultural fields as on milkweeds in other habitats. This would translate to a 62% reduction in monarch production over the decade if there was no increase in egg-laying on the remaining milkweeds. Data from the long-term Monarch Larva Monitoring Project is used to evaluate to what extent monarch use of non-agricultural milkweeds has increased over the last decade to compensate for the loss of milkweeds in agricultural fields. The milkweeds in CRP land are seen as being increasingly important to monarchs as the extirpation of milkweeds from agricultural fields continues.

54. LONG-TERM TILLAGE AND CROP ROTATION EFFECTS ON SOIL QUALITY AND PRODUCTIVITY ACROSS IOWA

Victoria Scott, Mahdi Al-Kaisi and Brad O'Neal
Iowa State University

The current challenge for agriculture is to not only feed, but to also help fuel the world. This growing demand for production has prompted the evaluation of different tillage and crop rotation practices and their effects on yield, agronomic relationships, and soil quality in order to better

understand the impacts and sustainability of current production systems. In a society where market values may soon be assigned to ecological and environmental services rendered by sustainable agricultural systems, a different perspective on the value of agricultural systems must be documented. Currently, rigorous validation of regionally appropriate models that include conservation practices such as no-till and reduced tillage and cropping methods that take advantage of diverse rotations are being called for (Greenhouse Gas Working Group, 2010). This study consists of eight locations across Iowa in complete randomized block designs with five tillage systems (No-tillage, strip-tillage, chisel plow, deep tillage, and moldboard plow) as treatments for corn-soybean, corn-corn-soybean, and continuous corn rotations. The sites are located at eight research and demonstration farms across the state representing different soil associations and climatic conditions. The objective of these studies is to assess the impacts of these systems on yield of corn and soybean crops and long-term impacts on soil quality indicators and soil carbon dynamics. The trends from these long-term studies indicate soil quality and agronomic response differences due to tillage and crop rotation. The studies will provide critical and vital information in the development of the most efficient and resilient production systems, guidelines for best management practices, and potential environmental mitigation practices.

55. EFFECT OF CORN-COB STORAGE ON FIELD FOR CELLULOSIC ETHANOL PRODUCTION ON SUBSEQUENT CROP DEVELOPMENT AND SOIL QUALITY

Carlos Tenesaca, Mahdi Al-kaisi and Brad O'Neal
Iowa State University

It is believed that corn-cobs stored on fields after harvest and left-over after removal from fields for cellulosic ethanol production can have negative impact on soil health and crop development by inhibiting or retarding corn seed germination and early growth. Preliminary findings of field and greenhouse evaluations show that corn growing under cob-affected soil has a slower growth rate compared with areas free of corn-cob. The exact reason for this phenomenon is unknown. However, there is a theory that the decomposition of the corn-cob residue left in the field during

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the winter and early Spring prior to corn-cob removal may produce organic compounds that are growth inhibitors. Also the high carbon nitrogen ratio may lead to nitrogen immobilization, which subsequently influences crop development and yield. We conducted field studies at four existing corn-cob collection areas located in northwest Iowa in 2010. Three of these sites preceded corn and one of the sites, soybeans. Intensive soil and plant sampling occurred prior to putting corn-cobs on the ground and during the growth season. Preliminary findings show a significant reduction in crop development in the area covered previously with corn-cob. There will be ongoing evaluation and lab studies to further evaluate the cause and effect of such materials on crop development in addition to soil biological, chemical, and physical changes.

56. EDUCATING NEW LEADERS IN CONSERVATION: THE PROFESSIONAL SCIENCE MASTERS IN ECOSYSTEM MANAGEMENT AT UNI

Laura L. Jackson and Mark C. Myers
University of Northern Iowa

Conservation professionals must call on a variety of talents in order to be effective leaders and managers. Strong academic fundamentals and coursework in ecology or natural resources should be combined with applied courses in ecological restoration and Geographic Information Systems. Beyond these attributes, our research suggests that conservation professionals need to be able to manage a project from start to finish and to navigate within a complex social environment of stakeholder groups and partners. To this end, the University of Northern Iowa has developed a Professional Science Masters (PSM) program in Ecosystem Management. PSM degrees allow students to develop advanced techniques within a scientific specialty, while simultaneously cultivating *soft* workplace skills such as communication and organizational management. The UNI PSM in Ecosystem Management is an intensive one-year, 30 credit program combining professional skills in communication, organization and management with modern ecological techniques. In addition to required coursework, students work closely with faculty, natural resource professionals and community members on and off campus to carry out a significant, multidisciplinary project, usually

involving multiple stakeholders. We review accomplishments and describe strengths and weaknesses of the program in its 4th year.

57. UPDATING THE NATURAL AREAS INVENTORY (NAI) DATABASE FOR RARE PLANTS IN IOWA

John A. Pearson¹ and Mark J. Leoschke²
Land & Water Bureau, Iowa Department of Natural Resources¹; Wildlife Bureau, Iowa Department of Natural Resources²

The Natural Areas Inventory (NAI) database has been under development by the Iowa Department of Natural Resources since 1981. Focusing on rare species of plants and animals, information is from a variety of sources including field surveys and collection of information from herbaria and literature. Over 15,000 records are presently contained in the database ranging from historical observations made in the 1800s to present day sightings. The plant portion of the database presently consists of ~10,000 records, of which 75% have been added since 2004 (during less than 25% of the program's 30-year history). This rapid growth has been enabled by the advent of interactive computer mapping, employment of interns to reduce a large data backlog, and current re-inventory of specimens in the state's herbaria. Records in the database are protected as *ecologically sensitive sites* within the Open Records Law (Iowa Code 22.7(21)) and are used by professional natural resource managers to identify opportunities for conservation, to improve natural resource management, to provide an objective basis for identifying species as threatened, endangered, and special concern, and to conduct environmental reviews to avoid conflicts between development and listed species.

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58. RISK FACTORS ASSOCIATED WITH WEST NILE VIRUS SEROPREVALENCE IN CENTRAL IOWA BIRDS^{ISF}

Natalie Randall, Julie Blanchong and Bradley Blitvich
Iowa State University

Along with the use of surveillance to monitor the occurrence of disease in wild animal populations, public health and wildlife management agencies' ability to predict where risk of exposure may be greatest, and to which populations, is important. In the Midwest, existing research suggests the prevalence of West Nile Virus (WNV) in humans and mosquitoes is linked to land use, but no data are currently available for birds, the primary amplifying host of WNV. Our study evaluated whether the risk of exposure to WNV in Midwestern peridomestic birds varied with land use to identify locations where birds were at greatest risk of contracting the virus. Over two summers, we captured and collected blood samples from birds in sites comprising gradients of urban, agriculture, and natural land uses. In addition, we explored if a bird's likelihood of being seropositive was associated with its taxonomic family, age, and sampling season/year. Our results suggest that a bird's risk of WNV exposure increases in urban areas, possibly because urban landscapes often harbor standing water favorable for mosquito vector reproduction. We also found that seroprevalence was higher within the Cardinalidae, Columbidae, and Turdidae families relative to other taxonomic families sampled. Heterogeneity among taxa may be due to variation in exposure, physiological response to infection, or survival. Lastly, our results indicated that risk of exposure was significantly greater in 2009 than in 2010. This disparity appears to be related to differences in weather, suggesting that annual variation in environmental conditions may strongly impact WNV exposure risk. Overall, this study identified several factors associated with WNV exposure in Midwestern peridomestic birds that might be useful for tailoring disease surveillance or management activities.

Engineering Section

Oral Presentations

59. MICROSTRUCTURAL AND ELECTROCHEMICAL IMPEDANCE STUDY OF NI/CGO ANODES FOR SOLID OXIDE FUEL CELLS FABRICATED BY ULTRASONIC SPRAY PYROLYSIS

Lin Liu, Gap-Yong Kim, Andrew C. Hillier and
Abhijit Chandra
Iowa State University

Large triple phase boundaries (TPBs) and high gas diffusion capability are critical in enhancing the performance of a Solid Oxide Fuel Cell (SOFC). In this study, ultrasonic spray pyrolysis has been investigated to assess its capability in controlling the anode microstructure. Porous nickel/gadolinium-doped-ceria (Ni/CGO) anodes were deposited on dense yttria stabilized zirconia (YSZ) substrates. The deposited anode microstructure was altered to enhance its electrochemical performance. The electrochemical performance of the anode was measured by Electrochemical Impedance Spectroscopy (EIS) using a Ni/CGO-YSZ-Ni/CGO symmetrical cell. The deposition temperature and precursor solution concentration were the most critical parameters that influenced the morphology, porosity and particle size of the anode electrode, which determined the anode electrochemical performance. The deposited anode had a particle size and porosity in ranging between 1.5-17 μm and 21%-52%, respectively. The corresponding area specific electrode resistance decreased from 5.45 ohm cm^2 to 0.61 ohm cm^2 and the activation energy decreased from 1.06 eV to 0.86 eV as the TPB length increased due to the decrease of the particle size and increase of the porosity.

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60. DYNAMIC OPTIMIZATION OF DISTRICT UTILITY GENERATION

Scott Jeffery Salsbery
University of Iowa

The University of Iowa Power Plant as an entity maintains utility generation and distribution for campus facilities. Typical utilities provided include chilled water, electricity and steam. It is desirable to be able to conveniently and effectively evaluate the optimal load combination of boilers, engines and chillers to meet the grid demand for minimal cost. An algorithm is under development which will take into account the performance of individual units as part of the mix which ultimately supplies the grid and determine the degree that each should be running to most efficiently meet demand. The second component is to couple the algorithm with accurate estimates and historical data through which expected demand could be predicted.

61. ANALYSIS OF MEDIUM TO LOW TEMPERATURE PYROLYSIS OF BIOMASS

Yunye Shi
University of Iowa

Gasification of biomass has become an area of significant interest, the key of which is to convert biomass such as corn kernels, oat hulls, and paper sludge into carbon monoxide, hydrogen, and methane which could later be processed into liquid fuel or electrical energy. The purpose of the present work is to explore the pyrolysis (a gasification process) and in particular pyrolysis behavior of wet and dry paper sludge and wood chips. For materials, medium to low temperature was studied. Here, tests were performed with pyrolysis temperature from 400-800°C, at 1 atm and a rapid heating rate. A small concentration of O₂ was added to gasification agent (N₂) to enhance CO yields, similar to modern industrial gasifiers. The evolution of CO, CO₂, CH₄, H₂ and O₂ were measured throughout the pyrolysis process. Results show a direct correlation between temperature and composition of the gas byproduct for all biomasses. CO production increases with the increase of temperature and CO₂ shows no temperature preference. No H₂ was observed in the composition because of the short residence time (0.2 seconds).

62. SPACE TECHNOLOGIES FOR MITIGATION OF ASTEROID IMPACT THREATS

Bong Wie
Iowa State University

This talk presents an overview of space technologies being developed for mitigating the future impact threats of NEOs (Near-Earth Objects). Sixty-five million years ago, a 10-km asteroid struck near the Yucatan Peninsula in Mexico and created the 170-km Chicxulub crater. Since 1990, most scientists believe that a global climate change caused by the 10 km asteroid impact may have caused the dinosaur extinction. Key technical issues associated with the deflection and/or disruption of an NEO which is in a collision course with the Earth are discussed. Although various deflection technologies, including nuclear explosions, kinetic impactors, and slow-pull gravity tractors, have been proposed during the past two decades, there is no consensus on how to reliably deflect or disrupt hazardous NEOs in a timely manner. Consequently, this talk will focus on the practical engineering aspects of such a technically challenging, complex astrodynamical engineering problem.

63. EFFECT OF EXPOSURE TIME AND SCAN STEP SIZE ON THE SIZE OF ULTRASOUND HISTOTRIPSY LESION

Jin Xu¹, Timothy A. Bigelow¹ and Hangil Lee²
Iowa State University¹; Ames High School²

Histotripsy uses high-intensity focused ultrasound (HIFU) to produce energetic bubble clouds inside tissue that can liquefy a specific region. The major advantages of this non-invasive acoustic scalpel over common surgical tools are precision, sharp borders and theoretically no damage to the non-treated region. This study experimentally investigated the effects of exposure time and scan step size on the size of histotripsy-induced lesion in agar samples. Agar gel, as the ideal and controllable tissue-mimicking medium, was made by mixing 6 grams of powder with 400 milliliters of purified water and leaving the solution in a vacuum chamber overnight. A targeted square region 0.45 cm wide (lateral to focal region) and 0.6 cm deep (along beam axis) was scanned with a single-element spherically focused source (1.1 MHz, 6.38 cm focal length, f/1.02). The peak compressional and rarefactional pressures were

approximately 100 and 17 MPa, respectively. The ultrasound exposure consisted of 20-cycle sine wave bursts with a burst period of 1, 3 or 6 milliseconds corresponding to the exposure time of 5, 15 or 30 seconds, respectively, which kept the number of pulses constant. The step size in the axial direction was 0.3 cm for scanning, but the lateral step size was varied as 0.45 cm, 0.225 cm, 0.15 cm, 0.075 cm or 0.0375 cm. Our histotripsy experiments successfully created holes inside agar except for the cases with the largest step size, and indicated that the holes generally had a larger size than the initially targeted region. However, under the condition of constant pulse number, shorter exposure time could be as efficient as those longer ones in the sense of producing lesions inside tissue; meanwhile, finer step sizes did not necessarily lead to apparently bigger holes. Therefore, both the exposure time and the step size should be carefully designed when planning ultrasound therapy exposures.

64. FUEL DROP SPREADING ON A SOLID SMOOTH SURFACE: NUMERICAL SIMULATIONS WITH THE VOF METHOD

Yan Zhang and Albert Ratner
University of Iowa

This work presents results of a numerical investigation of a single fuel drop impact onto a smooth, solid surface, which are validated with the comparable experimental data. The trends of contact angle's evolution are studied as the significant boundary conditions specified in the numerical simulations. Particularly, two distinct phases are observed during the evolution of contact angles: kinematic phase and spreading phase. The former phase is dominated by the initial kinetic energy whereas the latter one is affected by the interactions of the surface tension and viscosity. Two combined static contact angle-dynamic contact angle (SCA-DCA) models, based on the classic Jiang's correlation and an empirical exponential equation, are proposed and tested corresponding to these two distinguished phases. The new combined SCA-DCA models show significantly accuracy improving versus the SCA model and reduce the behavior information required as compared with the full DCA model.

Environmental Science & Health Section

Posters

65. FATHEAD MINNOW (*PIMEPHALES PROMELAS*) VITELLOGENIN CONCENTRATIONS BASED ON SIX-DAY BISPHENOL A EXPOSURES

Cassandra Pauley and Melinda A. Coogan
Buena Vista University

Xenoestrogens have been shown to affect reproduction in wildlife and may have adverse effects on humans because of their ubiquitous presence in the environment, resistance to degradation, and potential for accumulation in lipids. Bisphenol A (BPA) (2,2-(4,4-dihydroxydiphenyl) propane) is one of the most widely used synthetic chemicals in industry today. Bisphenol A is found in electronic equipment, automobiles, sports safety equipment, reusable food and drink containers, and many other products. It poses problems because it can seep from hard plastics and enter into aquatic systems. Numerous studies have shown that animals exposed to low doses of BPA exhibited significant weight gain in both female and male offspring, advanced sexual maturation, disruption of the regularity of the estrous cycle in females, and altered sexual differentiation processes in exposed male fish, with resultant and varied levels of vitellogenin (Vtg), an egg yolk precursor. This study reports whole body male fathead minnow Vtg levels following three incremental six-day BPA exposure rates. Vitellogenin levels were assessed by using a biosense Laboratories, Fathead Minnow Vtg ELISA kit. Exposure levels of BPA ranged from zero to 400 ppb with the following Vtg concentrations: control concentration of 0.126 ppb, Sample A concentration of 0.128 ppb at 50 ppb BPA level, Sample B concentration of 0.135 ppb at 100 ppb BPA level, and Sample C concentration of 0.236 ppb at 400 ppb BPA level. Results indicate increasing concentrations of Vtg production in response to increasing levels of BPA exposures.

E

nvironmental Science & Health Section

Oral Presentations

66. THE EFFECTS OF CADMIUM ON DROSOPHILA MELANOGASTER MATING BEHAVIOR

Cara Marie Voelliger, Kelsey Yerkes and Fred B. Schnee
Loras College

Cadmium and other heavy metals have been known to have harmful effects on humans, but the mechanisms of the damage still remain unclear. In this study, the mating behavior and survivorship of *Drosophila melanogaster* was observed in flies that were exposed to food containing 0, 0.1, 0.5 and 0.75 mM concentrations of cadmium chloride. It was found that while 0.1 mM cadmium did not have a significant effect on survivorship, the higher concentrations of 0.5 and 0.75 mM cadmium did significantly lower the survivorship of *Drosophila*. Cadmium also had a significant effect on mating, but unlike the results found for survivorship it showed a non-linear response. For mating behavior, exposure to 0.75 mM significantly decreased the copulation frequency of flies, while exposure of females to 0.1 mM cadmium significantly increased copulation frequency. In order to better characterize the effect of 0.1 mM on mating behavior, flies were also examined for the effect of continuous and short term (4 days) exposure to cadmium. Our results suggest that short term posteclosion exposure to 0.1 mM also has an effect on *Drosophila* mating behavior.

67. TICK-BORNE PATHOGENS IN WINONA COUNTY: *BORRELIA BURGDORFERI* AND *ANAPLASMA PHAGOCYTOPHILUM*

Lukas Wallerich and Jeanne Minnerath
Saint Mary's University of Minnesota

Tick-borne pathogens are capable of infecting humans with a number of harmful diseases, such as Lyme disease from *Borrelia burgdorferi* and Anaplasmosis from *Anaplasma phagocytophilum*. *Ixodes scapularis*, commonly known as the deer tick, is a well-established tick species within Winona County that is known to be a competent vector for the aforementioned bacterial pathogens. The purpose of this study was to collect deer ticks from various sites in Winona County and assess the prevalence of the tick-borne pathogens *Borrelia burgdorferi* and *Anaplasma phagocytophilum*. Deer ticks were collected from five separate locations in Winona County (approximately 100 ticks per site). DNA was extracted and analyzed for the presence of either pathogen using real-time polymerase chain reaction. Results indicated that, on average, 40% of the ticks were infected with *B. burgdorferi*, while 16% of the ticks were infected with *A. phagocytophilum*. These results are consistent with data collected from other regions within southeast Minnesota. Interestingly, 7% of the ticks were co-infected with both pathogens. This value was significantly higher than that observed in previous studies (2% co-infection). Surveillance studies such as this are important to monitor tick populations and their pathogens, as well as to insure that the public is aware of the prevalence of these tick-borne pathogens.

68. METOLACHLOR EXPOSURE LEADS TO CELL CYCLE EFFECTS

Sean P. Hartnett, Sadiatu Musah and Kavita R. Dhanwada
University of Northern Iowa

Metolachlor is one of the most commonly used herbicides in the United States. This synthetic herbicide is absorbed by susceptible plants and inhibition of protein synthesis occurs leading to death. While quite effective in killing weeds, several studies have shown that exposure to metolachlor results in decreased cell proliferation, growth and reproductive ability of non-target organisms. Howev-

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er, the mode of metolachlor action in non-target organisms has not yet been elucidated. The current study assessed effects of metolachlor exposure on immortalized human liver cells. Results from cell proliferation assays showed that a 72-hour exposure to 50 ppb metolachlor significantly inhibited growth of these cells compared to untreated controls while a decrease in the cell division rate required exposure to 500 ppb metolachlor for 48 hours. Flow cytometry analysis of cell cycle distribution revealed that 500 ppb metolachlor treatment resulted in fewer HepG2 cells in G2/M phase after 72 hours. Real-time PCR analysis showed a significant decrease in the abundance of the cyclin A transcripts after 12 hours in cells exposed to 300 ppb metolachlor. These results suggest metolachlor may affect progression through the S phase of the cell cycle and entrance into the G2 phase.

69. ATRAZINE METABOLITES, DEA, DIA AND DEDIA AFFECT GROWTH OF HUMAN LIVER CELLS

Rhianna M. Harm, Kelsey E. Lombard and
Kavita R. Dhanwada
University of Northern Iowa

Atrazine, a triazine herbicide used on corn and sorghum in the Midwestern United States, inhibits photosynthesis in broadleaf weeds. It is associated with various health effects in humans including hormone disturbances, cancer, and decreased functioning of the nervous and immune systems and organs including the heart, liver and kidneys. While the parent compound atrazine remains in the environment for various times, it can also be degraded into three primary metabolites: deethylatrazine (DEA), deisopropylatrazine, (DIA) and deethyldeisopropylatrazine (DEDIA). These metabolites are quite prevalent in the environment, but not much is known about their effects. The lack of information of their effects on human cells prompted this study as to whether DEA, DIA, and DEDIA could affect the growth of an immortalized human liver (HepG2) cell line. MTT cell proliferation assays were performed with a broad range of concentrations at different time points. Results showed DEA exposure led to decreased cell proliferation at relatively high concentrations of 750 and 1000 ppb after 72 hours while significantly decreasing growth with 1000 ppb after 24 hours. DIA also decreased cell

growth at lower concentrations of 250, 500, and 1000 ppb after 24 hours while only 100 ppb was enough to decrease growth after 48 hours and 72 hours. In contrast, DEDIA acted to significantly increase and decrease cell proliferation at low-dose vs. high-dose concentrations. The results of this study indicate that all three metabolites can be cytotoxic under acute conditions, but DIA is more cytotoxic than DEA and DEDIA and may possibly be even more cytotoxic than atrazine itself, which inhibited HepG2 cell proliferation at concentrations of 625 ppb and higher.

70. GOING GREEN: ARE GREEN PRODUCTS BETTER FOR THE ENVIRONMENT THAN TRADITIONAL CLEANERS?

Jessica Williams, Melanie Louis, Anna Colgan, Kirstie Engler and Nicole M. Palenske
Central College

As people are becoming more sustainable in their daily routines, one easy way to help the environment is through the use of green chemicals. Little has been investigated on what happens to these chemicals after their intended uses. The goal of this study was to investigate the toxicity and effects of the environmentally friendly Seventh Generation *green* household cleaning product versus the tradition *non-green* Formula 409 household cleaning product on fathead minnows (*Pimephales promelas*). We made serial dilutions for each product using 1.5 mL of the green product and 0.5 mL of the non-green product diluting each concentration with reconstituted hard water to 50%, 25%, 12.5%, and 6.25%. Five fathead minnows were placed in each concentration (with three replicates at each concentration) and placed in an environmental chamber maintained at $24 \pm ^\circ\text{C}$ for 48 hours. The LC50 for the green product was 1.089 mL, while the LC50 for the non-green product was 0.254 mL. Fathead minnows had higher survivorship levels with exposure to green household cleaning products than non-green household cleaning products. This study demonstrates the positive effects of using green household products as a means of preventing additional toxic chemicals from entering our water supply and affecting organisms in the environment.



Geology Section

Posters

71. SURFICIAL GEOLOGY OF THE DUNKERTON (IOWA) 7.5' QUADRANGLE, BLACK HAWK COUNTY, IOWA

Chad Elliott Heinzl, Nicholas W. Bosshart and Jordan C. Vastine
University of Northern Iowa

Our objective for developing the surficial geologic map of the Dunkerton Quadrangle is to obtain geologic data that can be used for county-specific land use planning tools for the city of Dunkerton, the Natural Resources Conservation Service (NRCS), and the local farmers. The geologic findings will also assist the development of groundwater permeability maps that will be used in the planning of potential sites for urban and agricultural developments. The city of Dunkerton and the surrounding Cedar Falls/Waterloo metro area need this data to improve their water resources management plans, wetland protection programs, aggregate resource management programs, and to determine the pollution potential from Iowa's growing confined animal farming operations (CAFOs). Sufficient data for our local natural resources is scarce for the production and interpretation of county specific land use planning tools. UNI's EDMAP program collaborated with Federal (NRCS, EPA), State (Iowa Geological and Water Survey), and local agencies to address the need for sufficient geologic mapping data.

72. MAPPING THE SURFICIAL GEOLOGY OF THE IOWAN EROSION SURFACE, NORTHEASTERN IOWA

Chad Elliott Heinzl, Nicholas W. Bosshart, Jordan C. Vastine, Drew Kreman, Adam Campbell and Jessica Schmitz
University of Northern Iowa

The Educational Component of the National Cooperative Mapping Program (EDMAP) is a collaborative effort be-

tween the USGS, local/state geological surveys and academic settings. The EDMAP program has two primary goals: (a) Foster the development of field mapping skills in students and (b) Construct useful high-quality geologic maps that benefit our geologic understanding of our local environments and evolving communities. UNI has partnered with the Iowa Geological and Water Survey and USGS to provide its students real world learning experiences. Students are collaborating with state geologists (STATEMAP), their professors and peers throughout the entire mapping process. Mapping includes idea development, literature and field reconnaissance, gaining permission to access land, field work, lab analyses, construction of final mapping deliverables and submitting these data for publication. UNI students are developing a greater understanding of the Iowan Erosion Surface specifically the Waverly (2008-2009), Readlyn (2009-2010) and Dunkerton (2010-2011) 7.5' Quadrangles. The UNI EDMAP Team is interested in characterizing northeastern Iowa's surficial geologic sediments to learn more about the geologic events that led up to the area's present distribution of landforms. The five primary surficial units identified, sampled, and mapped include alluvium (Qal), low terrace alluvium (Qal_{It}), sandy eolian sediment (Qe), sand and gravel (Qnw2, Noah Creek Formation), and loamy and sandy sediment to glacial till (Qwa2, unnamed reworked Pre-Illinoian till). Secondary mapping products also seek to identify the interrelationships of these surficial sediments with flooding events, contaminant transport, and development of karst topography and to help Iowa's communities develop sustainably.

73. GIS MAPPING OF GLACIAL ERRATICS, FAYETTE COUNTY, IOWA

Sarah Kray and Katherine McCarville
Upper Iowa University

To better understand the glacial history of Northeast Iowa, glacial erratics were mapped in Fayette County, Iowa. The locations of erratics, whether in place, buried, or moved, were gathered using hand-held GPS. Locations were classified based on their degree of uncertainty, and information including size, lithology, angularity and degree of weathering were collected. Student teams performed

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much of the data collection and some of the data synthesis. Lithologies of erratics may reveal the direction of ice transport. Soil maps incorporating information regarding parent material were used to identify or confirm the presence of glacial or outwash deposits with relation to the erratics. LiDAR imagery was used as a base map to reveal topographic features that might indicate primary glacial landforms or erosional landforms influenced by glacial or outwash deposits.

74. HEAVY METALS IN CEDAR RIVER SEDIMENTS ASSOCIATED WITH A SHOOTING RANGE IN BLACK HAWK COUNTY

Jeff Minnehan
University of Northern Iowa

This project is designed to determine if there are different concentration levels of selected elements in Cedar River sediments upstream and downstream of the Black Hawk Park shooting range in north Cedar Falls, Iowa. Two of the stream sediment samples were collected upstream from the shooting range, and two of the stream sediment samples were collected downstream from the shooting range. Four sediment samples were collected in the immediate vicinity of the shooting range. Preliminary results indicate that iron, aluminum, titanium, manganese, zinc, tin, and tungsten are more concentrated downstream from the shooting range. Additional work should determine if the higher concentrations are attributable to the presence of the shooting range along the Cedar River.

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G

eology Section

Oral Presentations

75. USE OF 3-D AND OTHER MODERN GRAPHIC TOOLS IN GEOLOGICAL INTERPRETATION

Raymond R. Anderson and Bill J. Bunker
Iowa Geological & Water Survey, Iowa Department of Natural Resources

The rapid expansion of the quantity and quality of digital geologic data in Iowa and the recent availability of advanced graphic tools allow geologists an unparalleled opportunity to produce instructive models of a variety of geologic data. At the Iowa Survey the principal tools used for this modeling are within ArcGIS, ArcMap and Arcscene. These tools allow the production of shaded-relief maps, cross-sections, fence diagrams, and 3-D models that not only aid in the visualization of data but also are powerful tools for refining and interpreting geologic data. Interactive graphics allow images to be viewed with differing angles of sun illumination, rotated for viewing from any perspective, or even animated. In this presentation we will demonstrate some of the graphic models developed and used at the Iowa Survey and discuss other possible applications for these powerful tools.

76. THE SUBDIVISION OF THE CHEROKEE GROUP ON THE NEW BEDROCK GEOLOGIC MAP OF IOWA

Thomas Robert Marshall¹ and John Paul Pope²
Iowa Geological and Water Survey, Iowa Department of Natural Resources¹; Northwest Missouri State University²

The Cherokee Group takes up a third or more of the Pennsylvanian column in Iowa and covers one of the largest areas on the new Bedrock Geologic Map of Iowa. As the updated version of the map was being prepared, it was decided that the Cherokee should be subdivided into two map units: Upper Cherokee Group and Lower Cherokee

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Group (including the Raccoon Creek Group), separating the more marine upper part from the more terrestrial lower part. In addition, the lower part contains more of the named coal beds in the Cherokee as well as some of the most economically significant coals in the Pennsylvanian. The subdivision was made above the Whitebreast Coal because it is regionally extensive and it underlies the Verdigris (Ardmore) Limestone, an important Cherokee marker unit. This is the first time the Cherokee Group has been officially subdivided in Iowa. Field mapping of the Whitebreast Coal was conducted by Dr. John Pope over the summer of 2007. Where surface exposures of the Whitebreast are absent, the position of the contact was based on well data and stratigraphic relationships. A more detailed mapping of the Cherokee Group could help better constrain the distribution of the economic coals in the Pennsylvanian. These coals may also play an important part in the future of energy and CO₂ sequestration in Iowa.

77. INDONESIAN-AUSTRALIAN SUMMER MONSOON VARIABILITY IN THE EARLY HOLOCENE

Elizabeth Greaves and Rhawn Denniston
Cornell College

Recent studies from Borneo and Indonesia have increased our understanding of the evolution of the Indonesian-Australian Summer Monsoon (InAuSM) system over the past 10,000 years (the Holocene epoch). However, little is known about the InAuSM in Australia or at centennial time-scales. Here we present carbon and oxygen stable isotope data from two stalagmites collected from cave KNI-51, located in the northern Kimberley region of tropical Western Australia, that preserve evidence of centennial- and millennial-scale trends in the InAuSM during the early Holocene. Monsoon intensity and variability are attributed primarily to the El Niño-Southern Oscillation at millennial and sub-millennial time scales; insolation appears to have played limited role on InAuSM variability during the Holocene.

78. RECONSTRUCTING TROPICAL CYCLONE FREQUENCY USING MUD LAYERS IN SPELEOTHEMS

Nicholas Campbell and Rhawn Denniston
Cornell College

Our ability to understand multi-decadal to centennial-scale trends in tropical cyclone activity is limited by the short duration of, and limitations in, historical records. In order to extend these records for the tropical Western Australia, we have analyzed mud layers in stalagmite KNI-51-11 from the Kimberley region of north-central Australia that appear to be formed by cyclone-induced flooding. KNI-51-11 grew over the last 250 years and contains 39 mud layers. High uranium and low detrital Thorium abundances in this aragonite stalagmite allow extremely precise dating (± 1 year over the past century) via U/Th mass spectrometry. Linear interpolation between 13 U/Th dates was used to establish an age model for the mud layers. When these mud layers are compared to historical storm records since 1906, the KNI-51-11 mud layers correlate 78% of the time with years in which tropical cyclones passed within 200 km of the cave.

79. COMBINED STALAGMITE AND LIMPET-BASED HOLOCENE PALEOCLIMATE RECONSTRUCTIONS FROM COASTAL PORTUGAL

Megan Denner and Rhawn Denniston
Cornell College

Few paleoclimate records preserve high-resolution information for the middle Holocene in (near) coastal Portugal, but this region contains many caves within a few kilometers of the coast. In addition, shells of shallow marine invertebrates record sea surface conditions, and some of these were harvested and preserved in archaeological middens. We attempted to develop a paleoclimate record from coeval, middle Holocene limpets and a single stalagmite from coastal Portugal. The stalagmite was collected approximately 30 m from the 1 m² entrance to the shallow but poorly ventilated Glory Hole cave near the town of Nazare. U/Th dating demonstrated that the stalagmite grew uninterrupted from 8.2-4.2 ka, and stable isotopic analysis revealed multiple episodes of oxygen isotopic variability in excess of 5‰ in as little as 100 years, changes

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that are unlikely to reflect shifts in mean annual temperature. Strong covariance between stalagmite $\delta^{13}\text{C}$ and $\delta^{18}\text{O}$ values argues for non-equilibrium crystallization, and thus we interpret these data as reflecting secondary controls on stalagmite isotopic ratios through kinetic effects and/or the evaporation and ^{18}O -enrichment of cave drip-water. Comparison with the GISP2 Greenland ice oxygen isotopic time series reveals increases in North Atlantic air temperature that were coincident with increases in evaporation influences at Glory Hole, suggesting a possible climatic link between the two sites. Limpet shells were cracked and in some places degraded, and despite careful preparation and delicate microsampling, we were unable to extract a stable isotopic time series of sufficiently high resolution to define seasonal shallow marine temperature variability. The background, methodology, and results of this study will be presented to Iowa public and private elementary, middle, and high school students along with supporting educational materials.

80. GEOLOGIC SETTING OF THE WINNESHIEK LAGERSTÄTTE - DECORAH, IOWA

Robert M. McKay¹, Huaibao P. Liu¹, Brian J. Witzke¹ and Bevan M. French²

Iowa Geological & Water Survey, Iowa Department of Natural Resources¹; Smithsonian Institution²

The Middle Ordovician (Whiterockian) Winneshiek Lagerstätte is found within the provisionally named "Winneshiek Shale" which lies disconformably beneath the Tonti Member of the St. Peter Sandstone at Decorah, Iowa. The 60 to 120 ft thick Lagerstätte-bearing shale is the uppermost facies of a 600+ ft sedimentary succession that fills a 3.6 mile diameter circular basin of suspected meteorite impact origin. This thick sedimentary sequence differs substantially from pre-St. Peter incised-valley and paleokarst fills as typified by subsurface sections assigned to the Readstown or Kress members of the St. Peter. One small outcrop, water well cuttings and two short cores comprise the samples available for study. Basin facies beneath the "Winneshiek Shale" consist of sandstone, conglomerate and breccia containing abundant angular clasts of Lower Ordovician Prairie du Chien Group dolomite and chert, and lesser amounts of Upper Cambrian glauconitic

sandstone. A deep well near the basin edge provides evidence for normal faulting with 350 ft. of offset of the Jordan Sandstone. A second deep well, with gamma log, provides data to suggest that the Cambrian Wonewoc Sandstone forms the floor of the basin near its center; it also documents the presence of a marine shale facies containing eurypterid fragments and chirognathid conodonts in the lower part of the sedimentary fill. The possible origin of the structure by a meteorite impact event is suggested by the general circular shape, the anomalous stratigraphy, and the presence of quartz grains in well cuttings and core that show planar microdeformation features that resemble shock-produced planar fractures (PFs) or cleavage similar to those found at the Rock Elm impact structure, Wisconsin. However, unlike Rock Elm, no zone of central uplift or rebound is apparent. We are continuing studies of this unusual structure, and especially of the quartz deformation features, to explore the possibilities of a second impact structure contemporaneous with Rock Elm, and the possible role of multiple impact events in the Great Ordovician Biodiversification Event.

81. FOSSIL CORALS OF IOWA DATABASE

John P. Dawson

Kirkwood Community College

The fossil record of Iowa is one of the best examples of Paleozoic age rocks. Much has been written about the general stratigraphy and the various fossil groups. For this study, I have focused on the fossil corals of Iowa. Several researchers have worked on corals in Iowa, but none have spent much time going across major groups and/or time periods. In particular, there has been good work done on the Devonian Rugose corals and Silurian Tabulate corals, but not for some of the other periods in Iowa. A database of fossil coral occurrences in Iowa has been designed based on the Neogene Marine Biota Tropical America (NMITA) database. This project is in the early stages with a limited number of records in the database. However, there are several emerging patterns already. There are several "garbage" taxa where workers have placed many species into the genus without any serious regard to what characteristics should be used to distinguish species. This includes the Silurian Tabulate genus *Favosites* and the

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Devonian solitary Rugose coral genus *Zaphrentis*. It has also been the long tradition to ignore the solitary Rugose corals and record them solely as a horn coral, which reflects both the difficulty to identify the taxa in the outcrop and a lack of many diagnostic characters. Another pattern is the lack of work on the Pennsylvanian and Mississippian corals even though they do exist in Iowa. This presentation will give a general overview of the fossil coral record in Iowa, discuss the structure of the database being created, and give some general notes and observations about the paleoecology and paleobiology of the fossil corals in Iowa.

82. GIANT CELLS: EVOLUTIONARY SIZE INCREASE IN FUSULINOIDEAN FORAMINIFERA

John Groves

University of Northern Iowa

Fusulinoideans are extinct protists whose fossils are abundant in Pennsylvanian and Permian rocks. Median fusulinoidean shell volume increased by more than three orders of magnitude in Pennsylvanian and earliest Permian time, a period of 20 million years. The size difference between the smallest and largest fusulinoideans during this same interval was nearly six orders of magnitude, or, in relative terms, roughly the same as between a mouse and an elephant. The dramatic increase in fusulinoidean size occurred during a radiation in which the clade produced several thousand species. The radiation likely was triggered by the advent of photosymbiosis, which enabled the host fusulinoideans to invade and diversify in low-nutrient environments. An adaptive consequence of photosymbiosis, at least under stable conditions, is delayed reproductive maturity and growth to large size. Thus, photosymbiosis probably accounts for the driven component of the size trend. Even though photosymbionts provide their hosts with oxygen during daylight hours, the host-symbiont partnership is a net consumer of oxygen at night and under irradiances sufficiently high to induce photoinhibition. Therefore, the upper limit to cell size in symbiont-bearing foraminifera is constrained by the rate at which oxygen diffuses into the cell, just as in nonsymbiont-bearing counterparts. The very large volumes (and corresponding very small surface/volume ratios) achieved by many fusulinoi-

deans likely were permitted by increasing oxygen levels that characterized Pennsylvanian and Early Permian time. The strong temporal correlation between median fusulinoidean size and pO₂ suggests that hyperoxic conditions might have eased diffusion-related constraints on cell size and account for the passive component of the size trend. Fusulinoidean associations decreased in size beginning in late Middle Permian time, and the pursuant end-Guadalupian extinction resulted in the elimination of all large, internally complex forms. This decrease in size coincided with a steep decline in pO₂, further underscoring the relationship between size and available oxygen.

83. COMPILING MINERALOGICAL DATA AND REINTERPRETING MINERALIZING EVENTS ASSOCIATED WITH MID-CONTINENT RIFT VOLCANISM IN IOWA: SOME PRELIMINARY OBSERVATIONS

David W. Pals

Iowa Geological and Water Survey, Iowa Department of Natural Resources

Historically, intrusions spatially associated with the continental rifting have been of interest as copper-nickel-sulfide prospects. The traditional exploration targets were areas showing up as gravity anomalies from airborne geophysical surveys. New insights into the geologic processes involved in forming deposits containing copper, nickel, and platinum group elements have led to reevaluation of existing data and new discoveries have been made, including world class deposits associated with the mid-continent rift system in North America and proto-Superior and Superior Cratons. Petrographic studies of drill core from Iowa identify, what is understood today as, important mineral assemblages commonly associated with magmatic processes capable of concentrating elements in economically viable quantities. Contemporary exploration modeling of the rift-related intrusions in Iowa would lead to a better understanding of more than 80% of Iowa's geologic history. Reevaluation of existing core from previous drilling targets in Iowa could provide a valuable insight to the processes forming the Precambrian basement of Iowa as well as evaluate potential copper-nickel-platinum group element mineralization.

Iowa Science Teaching Section

Posters

84. THE EFFECTS OF PROCESS ORIENTED GUIDED-INQUIRY LEARNING (POGIL) IN THE ORGANIC CHEMISTRY CLASSROOM

Amanda Borchers and Leilani L. Zart
Wartburg College

Science educators at all levels find it difficult to teach large amounts of information in a short amount of time, while keeping students engaged. Process-Oriented Guided Inquiry-Learning is a form of team-based discovery learning that is intended to bridge the gap between the necessity of lecture and the fear of inquiry. To date, little research has been published regarding the use of POGIL. We hypothesized that POGIL would increase Organic Chemistry I scores, provide a more positive learning experience and build critical thinking skills. POGIL activities were created and implemented into the organic chemistry classroom. A significant difference was found between the experimental groups and the control group, as well as the students' POGIL based exam questions and lecture based exam questions, supporting the hypothesis stated above.

85. TRENDS IN ENVIRONMENTAL CONCERN BY GRADE LEVEL: A STUDY OF ELEMENTARY, MIDDLE, AND HIGH SCHOOL STUDENTS

Ryan David Lensing¹ and Dawn Del Carlo²
Dowling Catholic High School¹; University of Northern Iowa²

Environmental concern has been frequently measured since the 1970's, however, much of this research has focused on adults. Of the studies that look at students, the majority focus on high school with little attention given to middle or elementary grades. None of these studies have looked at elementary, middle, and high school students

from the same population. This study uses the NEP Scale for Children in conjunction with free response questions to examine the trends in environmental concern from 120 Catholic elementary, middle school, and high school students from Des Moines, Iowa. The findings show no significant differences in levels of concern for the dimensions of anti-exemptionalism and belief in an eco-crisis, but show that levels of concern for rights of nature is significantly higher in elementary and middle school grades when compared to high school. It was also found that as students increase in grade level, less concern is placed on simple environmental issues like pollution and destruction of nature, while more concern is placed on complex issues like climate change. Implications for curriculum design and environmental programming are discussed.

86. DEVELOPING VIRTUAL ENVIRONMENTS FOR CONSERVATION EDUCATION: A WORK IN PROGRESS

Jeremy Payne, Joseph Elarde and Aaron Haines
Upper Iowa University

A growing educational medium being used in academia is the use of multi-user virtual environments (MUVE), which are 3-D graphical worlds used to construct simulated immersive experiences. These graphical worlds are proving promising for educational applications because MUVEs can simulate environments and experiences not possible in classroom settings. The goal of this project is to develop a virtual environment for conservation education by using the Virtual Pheasant Model as a Pilot Project. We obtained GPS tracking data from wild pheasants (*Phasianus colchicus*) in their environment and revisited these locations to take images of pheasant habitat using a 360° camera. We then used these images to make the pheasant's environment virtual. Within this virtual environment we can then use a pheasant as an avatar so students can explore the native Iowa ecosystem to identify ecological principles that allow a pheasant to survive and reproduce within the native Iowa prairie.

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87. INTRODUCTION TO GIS FOR UNDERGRADUATES IN NATURAL RESOURCE ECOLOGY & MANAGEMENT

Paul Daniel Blom Skrade
Iowa State University

Ecological Methods (A Ecl/Biol 371) is an upper-level course in the Department of Natural Resource Ecology & Management at Iowa State University. Not simply a techniques course, it integrates topics from lectures and labs such as population and landscape ecology so that students learn the skills needed to identify and solve applied ecological and wildlife management problems. Geographic Information Systems (GIS) have become an integral component of ecological research and natural resource management. Over the course of three, 3-hour lab periods students in 371 use ESRI ArcGIS to create, manipulate, and display geographic data from the Iowa 4-H Center in Boone County. Students learn skills such as calculating distances and areas and quantifying habitat through several different exercises, one of which is to estimate the amount of seed needed to plant a 20 m buffer of the roads in the camp to prairie. For the final unit project the students must create a habitat map of the area with the locations of potential sites for trail cameras. The students determine placement of cameras based on available habitat types and a literature review of White-tailed Deer habitat use, with the proposed goal of estimating deer abundance and sex ratio.

Iowa Science Teaching Section

Oral Presentations

88. EII PRESENTS: RAIN, RUNOFF, AND RIVERS: UNDERSTANDING WATERSHEDS

Barbara Ehlers¹ and Carl Bollwinkel²
Upper Iowa University¹; University of Northern Iowa²

Iowa Core, 21st Century Skills, and floods...how do these tie together? The eii teaching model integrates the Iowa

Core's Essential Skills and Concepts and Characteristics of Effective Instruction to explore the concepts of watersheds. Activities will help students come to an understanding of the timely environmental issue, "Should action be taken to change the runoff of our own watershed?"

89. SCIENCE SAFETY IN IOWA AND THE NATIONS ACADEMIC SETTINGS: A SERIOUS PROBLEM

Jack A. Gerlovich¹ and Dennis McElroy²
Drake University¹; Graceland University²

As science safety researchers and publishers of numerous studies across the nation, these authors have been surprised by the recent, dramatic, increase in accidents in academic science settings across the nation. Several of these have resulted in court cases and dramatic lawsuits. With the recent emphasis on "hands-on, inquiry-based" science teaching, it is critical that teachers pay more attention to the need for safety. The authors will demonstrate some of their 20 years of published research - recently recognized by the Ohio courts as "the accepted standard for safety in academic science settings" - in settling a case in which 2 female students were burned over 70% of their bodies and huge amounts of money changed hands. They will also discuss two published (*Journal of the Iowa Academy of Science*, 1998, 2002) research studies concerning the status of safety in Iowa schools. They will demonstrate tools, customized to Iowa laws and codes, for addressing these needs. Research shows that the "inquiry" method of teaching and learning is the best way for students to learn the subject, enjoy it and secure careers in the field. Safety must become an essential part of every course.

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Organismal Biology Section

Posters

90. DIFFERENCES IN LEG AND PECTORALIS MUSCULATURE IN FACTORY FARM AND FREE-RANGE CHICKENS

Jessica B. Byerly and Elizabeth J. Queathem
Grinnell College

As the chicken industry has turned to factory farming, the lack of exercise possible in the crowded conditions has produced as adverse effect in the leg strength of chickens (Bessei 2006). Free-range farms offer an alternative, with chickens having more opportunities to exercise due to their access to the outdoors. In order to examine the differences in leg and pectoralis muscle mass based on these different exercise regimes, 5 chickens were dissected from a factory farm and 5 chickens were dissected from a free-range setting, and their muscle mass and strength were compared. This study found that the free-range chickens had more muscular legs and larger pectoralis muscles than their factory farm counterparts. These data indicate that purchasing a free-range chicken not only provides the consumer with a more ethical and quality choice, but with more leg and breast muscle with increasing total chicken mass.

91. CLINAL DISTRIBUTION OF CHROMOSOMAL POLYMORPHISM IN *DROSOPHILA AMERICANA* ¹⁸⁸⁸

Abigail Thomas¹, Kaci Wiegand¹, Bryant McAllister² and Paulina Mena¹
Central College¹; University of Iowa²

Geographically distributed polymorphisms suggest the presence of natural selection in response to variable climate. Chromosomal inversions are a common polymorphism associated with climatic gradients. Their hypothesized role is to protect co-adapted gene complexes. *D. americana* is an excellent model for examining the involve-

ment of genome organization in facilitating a correlated response to environmental conditions. A chromosomal rearrangement consisting of a centromeric fusion between the autosomal 4th and the X is present in *D. americana*. Frequency of the X-4 fusion is positively correlated with latitude. Neutral loci show no detectable population structure, suggesting substantial gene flow among populations. The maintenance of the X-4 fusion cline suggests a balance between gene flow and natural selection. Several polymorphic inversions are also present in *D. americana*. Chromosome 5 possesses two inversions: In(5)a is a large submedial inversion, while In(5)b is small and subterminal. Here we report the geographic distribution of these inversions by examining samples throughout the species' range. These inversions show a clinal distribution, with In(5)a found in higher frequency in southern populations and In(5)b increasing in frequency in more northern and western populations. Interesting, these inversions are found in extreme linkage disequilibrium. Chromosomes with both inversions or with the standard arrangement throughout were not observed. However, several populations are polymorphic for both inversions and heterozygous individuals were observed, suggesting that recombination between these inversions should be possible. Still, recombinants are never found in natural populations, implying that natural selection is acting to maintain these in linkage disequilibrium. These data indicate that 5 standard and especially 5ab are unfit karyotypes. Future studies will involve measuring recombination rates between these inversions to verify if recombinants are produced as we hypothesize.

92. THE EFFECT OF TEMPERATURE ON SEX DETERMINATION AND FITNESS IN PAINTED TURTLES

Kevin Wenceslao, Kevin Wenceslao, Robert Literman, Robert Literman and Nicole Valenzuela
Iowa State University

In most vertebrates, a mechanism called genotypic sex determination (GSD) is often responsible for determining the gender of an organism at conception through sex chromosomes. But in many reptiles and some fish, the environment actually takes on that role in determining the sex. Specifically, this study explores the effect of tempera-

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ture on determining the sex ratio of *Chrysemys picta* as a possible model for other reptiles. Instead of only incubating the hatchlings at constant temperatures, the effects of fluctuating temperatures were tested to more accurately represent the conditions of a nest in its natural environment. Furthermore, since temperature can also affect other genes that play a part in development, we explored the consequences of temperature regimes in various other phenotypic traits, such as size and morphology. Given that body size is intimately linked to fecundity and survival in the wild, these data shed light on the fitness effects of incubation conditions.



Organismal Biology Section

Oral Presentations

93. COLOR PERCEPTION IN *DROSOPHILA MELANOGASTER*

Serena L. Geisinger, Molly A. Urness, Carl Krambeck and Allison Peyton
Buena Vista University

Drosophila melanogaster's ability to perceive and differentiate color has been studied. In our own apparatus, the flies were introduced into a maze where they could select red, blue, green, and yellow in four equal arms of the maze. Each arm of the maze then branched off into a second selection of red, blue, green, and yellow. This provided a test and retest method to ensure that we are studying the flies' actual preference. We used funnels to ensure that once the fly made a color choice, it could not change its mind. Flies were scored in order to determine their color preference. Our results show *D. melanogaster* has color perception abilities. Various eye mutants in *Drosophila* were tested to determine if color preference is based on eye shape or color. In a second part of this experiment, flies that made the same color choice were bred together in an effort to select for a genetic predisposition for a particular color preference. Subsequent generations of flies

were then tested to determine if color differentiation was hereditary.

94. INVESTIGATING THE GENETIC BASIS OF TOLERANCE OF ALLELOPATHIC INVADERS

Eric Baack and Adam Ragheb
Luther College

Spotted knapweed (*Centaurea stoebe*) is an invasive species found on sandy soils in Iowa and neighboring states. Part of the success of spotted knapweed as an invader may be due to the production of toxic compounds, potentially catechin. Given time, native species may evolve tolerance of these invaders. We sought to understand the genetic nature of this response by examining the effects of spotted knapweed on *Arabidopsis thaliana*. We used 160 recombinant inbred lines (RILs) of *Arabidopsis thaliana* which have genotyped at 69 loci. Each RIL was subjected to one of three treatments: daily watering (control), daily treatment with the liquid that flowed past through the roots of greenhouse-grown spotted knapweed, or a one-time treatment with catechin. Markers associated with differences in growth between control and treated plants were analyzed using composite interval mapping. No regions were significantly associated with tolerance of knapweed flow through, but one region was associated with tolerance of catechin.

95. DETECTION OF BACTERIA USING PURIFIED FIREFLY LUCIFERASE⁷⁸⁸

Sarah Kennedy and Casey Finnerty
Saint Mary's University of Minnesota

Bioluminescence is the ability of living things to produce light without heat, and it is a rare trait to have; however, bioluminescence can be found in more than 13 phyla and is thought to evolve from 30 different origins. The focus for this experiment is on fireflies. However, fireflies are not flies at all, they are actually a type a beetle that belongs to the Lampyridae family (Day, 2009). What makes fireflies glow is a luciferin-luciferase reaction that was discovered in the 1950's (Sperelakis, 1998). A study conducted by Hysert et al., in 1976, showed that with increasing ATP

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levels the light output from luciferase activity also increases. By using ammonium sulfate fractionation these investigators purified the enzyme luciferase, and sixty five percent of the luciferase activity was recovered, while the specific activity had increased five times that of the original extract. The major goal for this experiment is to apply their protocol to the purification of luciferase obtained from wild caught fireflies and/or commercially available firefly lanterns (Sigma), and then use this luciferase for the detection of bacteria. Once the fireflies are collected their abdomens will be lyophilized and then ground using a chilled mortar and pestle and then dissolved in 5 ml of buffer. This solution will then be subjected to ammonium sulfate fractionation at 40-50% saturation. A standard curve will be established by using the purchased ATP and Firefly Lantern Extract Powder in different known concentrations. The purity of the luciferase will be determined using SDS PAGE analysis. The purified luciferase will then be applied to a bacterial quantification assay using lab cultures as well as bacterial swabbed from human teeth.

96. SPATIO-TEMPORAL VARIATION IN A MISSISSIPPI RIVER TURTLE COMMUNITY

Casey J. Arensdorf and Gerald L. Zuercher
University of Dubuque

In order to assess the importance of small-scale spatial and temporal diversity on community structure of river turtles, we sampled on and around 9-Mile Island within the Upper Mississippi River Wildlife and Fish Refuge (Pool 12) between May and September during 2009 and 2010. Four sites were sampled: the main channel side of the island (MC), the Molo Slough side of the island (MS), a backwater area located on the south end of the island (BW), and a small side-channel that runs within the island (SC). We captured six species of river turtles during this project: *Apalone spinifera* (spiny softshell), *Chelydra serpentina* (snapping turtle), *Chrysemys picta* (painted turtle), *Gratemys geographica* (common map turtle), *G. ouachitensis* (Ouachita map turtle), and *G. pseudogeographica* (false map turtle). Despite an overall decrease in captures in 2010 compared to 2009, some patterns emerged. The backwater site yielded the highest captures in both years. Turtle community structure changed at both

the backwater and Molo Slough sites between 2009 and 2010. Abiotic factors may have negatively impacted our success at capturing turtles as both years experienced deviations from average. In 2009 temperatures were consistently below average, while in 2010 river depth was higher than average.

97. COMPARISON OF LEAF CRYSTAL MACROPATTERNS IN THE ALLIED GENERA *PEPEROMIA* AND *PIPER* (PIPERACEAE)

Harry T. Horner, Tiranee Ruchti and Hana Yoon
Iowa State University

Many angiosperms produce calcium oxalate crystals in some or all of their plant organs, most notably in their leaves. Crystals have different individual or aggregate shapes and are spatially distributed within an organ. These two characters are species specific. Leaves are most amenable for study as they are plentiful and easy to process. Cleared fresh or herbarium leaves, using household bleach, ethanol and xylenes, are semi-transparent and display retained cell walls and inorganic crystals when viewed between crossed polarizers with a light microscope. Leaf crystals of *Peperomia* and *Piper* species were revealed as: (1) having distinctly different crystal shapes; and (2) having different crystal locations or macropatterns. *Peperomia* species exclusively display druses throughout or concentrated over the veins in the palisade parenchyma, and sometimes either raphide bundles or prisms in the spongy parenchyma; all creating at least seven leaf crystal macropatterns. *Piper* species studied so far have a more complex array of crystals shapes and macropatterns consisting of: small single needles, crystal sand, very small druses, and raphide bundles; and various combinations of them. Analysis of species not yet processed from both genera may identify additional crystal shapes and macropatterns that bridge both genera. The observed macropatterns will be compared to published phylogenetic trees for the two genera to determine if species with the same or nearly the same crystal macropatterns in each genus are closely associated with each other. These results will be further used to ascertain whether crystal shapes and crystal macropatterns serve as useful taxonomic and phylogenetic characters within these genera.

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Posters

98. FEASIBILITY OF A WIND HYBRID ENERGY FIELD ON UNITED STATES' WATERS

Jonnie Becker, Paxton Hinders, Denver Landers, Harley Hummel and Cody Swingen
North Butler High School

Society has become heavily dependent upon fossil fuels and this dependency is expensive. The Earth Science Research Cohort of North Butler (ESRCRCONB) is investigating the feasibility of creating a wind and wave alternative energy field on a large water mass native to the United States. Through all the research thus far, it has been decided that the work done in offshore wind energy is very underdeveloped, generally using a simple beam to anchor the propellers and generator in one spot. ESRCRCONB has made a prototype of a wind energy generator and completed a researched review of the bathymetry of the Great Lakes and a background in wind production. It was determined that possible sites include the Aleutian Islands in Alaska, the Northern California and Southern Oregon coastlines, Lake Erie, and potentially Coastal New England. Current communications with the local industry and university connections will be necessary to make future advancements.

P

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Oral Presentations

99. NANOSTRUCTURED MATERIALS: THE WORLD'S SMALLEST MISTAKES

Timothy E. Kidd, Laura H. Strauss, Paul Shand, Aaron O'Shea and Kayla Boyle
University of Northern Iowa

Over the past two years our group has been investigating a class of materials known as the layered dichalcogenides. They are structurally similar to graphite, and are known to have novel electronic and tribological properties. Like graphite, they can be readily peeled apart into thin layers or induced to roll up nanotubes or other fullerene shapes, which has led to some investigations into dichalcogenide nanostructures. In our investigations, Murphy's Law has reigned supreme with an array of scientific misadventures. Attempts to grow large, single crystals of a new dichalcogenide species led to a moldy looking patch of fuzz emerged the growth ampoule. Attempts to measure the surface with scanning probe microscopes led to seemingly random images for weeks. Even electron microscopy, which is a normally simple measurement, led to very strange results. After close examination, however, these mistakes actually turned out to be new and exciting results. The moldy mess turned out to be an array of doped nanotubes with possibly unique magnetic characteristics. The random images seen by scanning probe and scanning electron microscopy were actually due to the sample being altered by the measurement. This discovery has led to new routes for creating nanostructures on the surface of these materials. These results, along with a few *less successful* mistakes, will be presented as potential routes for systematically creating new forms of nanostructured materials with potentially exciting electronic or magnetic applications.

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100. MEASURING THE NEAR-NOTHINGNESS OF INTERSTELLAR SPACE WITH RADIO ASTRONOMY

Steven R. Spangler
University of Iowa

The gaseous material in the space between the stars is called the interstellar medium. The interstellar medium is of importance in astronomy because stars form from this matter. However, it is unbelievably rarefied by terrestrial standards; a relatively dense part of the interstellar medium has a density 17 orders of magnitude below that of the Earth's atmosphere at sea level. In this talk, I will describe how radio astronomical measurements diagnose important properties of the interstellar medium, such as its density, magnetic field strength, and turbulence characteristics. An important class of measurements utilize the slight departure from unity of the refractive index of radio waves in the interstellar medium. This change in the refractive index occurs because much of the interstellar medium is an ionized gas or plasma, and the refractive index of a plasma depends on the density of the ionized gas and the interstellar magnetic field. I will illustrate this technique with research carried out at the University of Iowa, in which measurements of an effect called Faraday rotation are made with the Very Large Array radio telescope of the National Radio Astronomy Observatory. In one type of investigation using Faraday rotation, we study how recently formed, luminous stars modify the interstellar medium in their vicinity.

101. TIME-DEPENDENT PROBLEMS IN RELATIVISTIC QUANTUM MECHANICS

Athanasios Petridis, Zach Kerzman and Kinlay Win
Drake University

The time-dependent relativistic Dirac equation can be employed to address a large number of quantum phenomena in which the time dimension can be essential. These include non-exponential decay, the Aharonov-Bohm effect with pulsed electron beams, spin-waves, the propagation of electromagnetically or strongly coupled fermion-antifermion systems in free space and media (such as the J/Ψ boson in quark-gluon plasma), and the dynamical mass of self-interacting fermions and its renormalization.

For most such phenomena analytical solutions to the Dirac equation cannot be obtained in any realistic situations, especially when the initial states are not energy eigenfunctions, and numerical solutions are sought. The staggered-leap-frog method has been used to numerically integrate the time-dependent Dirac equation. This method has been shown to be accurate and can be forced to be stable. It can be efficiently run on any desktop computer. The simplest system to study consists of a single electron wavepacket. Results on the position and spin jitter are in agreement with earlier calculations that used more complicated algorithms running on supercomputers. Relativistic decay of systems initially set in finite potential wells exhibits a strong non-exponential behavior, enriched, relative to the non-relativistic case, by the Klein-effect. Pulsed electron beams, that is electron wave packets, offer an opportunity to resolve the relativistic Aharonov-Bohm effect, the coupling of the fermions directly to the four-vector potential even in regions of zero vector-field, from other phenomena that can imitate it. In particular, the effect produced by a long solenoid can be disentangled from those of residual dipole fields and induced Coulomb interactions because of the time domain. This also allows for a direct look at the topology of the electromagnetic vacuum. Work on the time-resolved propagation of mutually coupled electron-positron and quark-antiquark systems is in progress. Substantial differences in the rate of spreading of the combined probability densities are observed compared to the free case. The study of the dynamical, time-dependent mass of fermions presents great challenges due to the ultraviolet divergence which could be numerically removed with statistical techniques.

102. GROWTH AND CHARACTERIZATION OF NANOSCALE THIN FILMS

Erik Wolter, Timothy E. Kidd and Aaron O'Shea
University of Northern Iowa

A vacuum chamber was constructed for the purpose of depositing thin metal films. This chamber replicates the conditions of outer space to prevent contamination. The thin films were grown by heating the materials to extreme temperatures until the metal evaporated. The materials were then deposited on glass in nanometer thick films.

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Their electrical and physical properties were then determined using scanning electron and atomic force microscopy and conduction measurements performed during growth. Resistance of the films is measured and recorded in situ to obtain the resistivity of the metal as it changes thickness. Temperature, pressure, and growth rate are recorded to assist the explanation of the changes in experimental data. The electrical, optical, and magnetic properties of macroscopic metals differ drastically from metals grown at the nanoscale. We hope to use the unique properties of nanotechnology to its maximum potential in electronic applications and solar cells.

103. PROBING NUCLEON STRUCTURE WITH SPIN AT RHIC

John Lajoie
Iowa State University

Spin-polarized deep-inelastic scattering in the late 1980's and early 1990's made a remarkable discovery, namely, that the spin of a proton was not carried predominantly by the constituent quarks. This discovery, often referred to as the *spin crisis*, implied that the spin of a proton is generated by the dynamics of Quantum Chromodynamics (or QCD, the *strong* nuclear force). Because of this, we can use spin as a tool to further our understanding of bound systems of quarks in QCD. The PHENIX experiment at the Relativistic Heavy Ion Collider has an extensive physics program to study both transverse and longitudinally spin-polarized p+p collisions over a range of energies. In this presentation I will review what the PHENIX experiment has learned from the first ten years of operation of the world's only spin-polarized collider. I will also discuss the plans the PHENIX collaboration has been developing for the next decade of RHIC operations, where we will greatly extend the physics reach of spin measurements in polarized p+p collisions.

104. VELOCITY, TEMPORAL, AND GENERALIZED KIRCHHOFF GAUGES AND WILTON'S VECTOR DIAGRAM

Kuo-Ho Yang¹ and Robert D. Nevels²
St. Ambrose University¹; Texas A & M University²

We derive the dyadic Green function for the velocity gauge in the time domain with an arbitrary parameter v and show that it reduces to the Lorenz and Coulomb gauge Green functions in the limit as v goes to the speed of light (c) and to infinity, respectively. We also derive the Green function for the generalized Kirchhoff gauge in the frequency domain and show that it reduces to the results of the Coulomb and the temporal gauges as special cases. Wilton's vector diagram that displays the electromagnetic field vectors and potentials in solenoidal and lamellar coordinates is reviewed and diagrams for several gauges are presented and compared.

105. THE PHYSICS OF GRAPHENE

Jigang Wang
Iowa State University and Ames Laboratory

Graphene, a novel material made of a single atomic layer of carbon atoms, has very promising mechanical, electrical and optical properties. Electrons in graphene behave in many ways different from ordinary metals or semiconductors and are rather similar to relativistic particles that governed the early stages of the universe. This talk gives a summary of the exciting properties of this unique two dimensional material, along with some of the potential applications.

106. VELOCITY REDISTRIBUTION AND HYPERFINE STATE CHANGING COLLISIONS IN RB-AR COLLISIONS

Mike Henry and David Olsgaard
Simpson College

Diode laser spectroscopy near 780 nm was used to investigate velocity redistribution and hyperfine structure state changing collisions in rubidium as a function of argon pressure. The narrow (~ 10 MHz) bandwidth of semiconductor diode lasers easily resolves the hyperfine structure of the rubidium ($5S_{1/2}$) ground state but the upper state

($5P_{3/2}$) hyperfine structure is not resolved. The result is an effective three-level system where optical pumping from one ground state hyperfine level to another (via excitation to the $5P_{3/2}$ level) may take place. This pumping quickly transfers most of the population to the optically uncoupled ground state hyperfine level (called a *dark state*). To observe this effect a strong pump laser is tuned to a fixed frequency within the Doppler broadened profile of one of the hyperfine transitions. The pump laser burns a hole in the velocity distribution of atoms in this hyperfine level while a second probe laser scans the manifold of $5S_{1/2}$ to $5P_{3/2}$ hyperfine transitions. In the absence of collisions the transfer of one velocity group to the dark state is easily observed. In the presence of argon collisions it is expected that velocity changing collisions would enhance the pumping by continually thermalizing the Maxwell velocity distribution of rubidium atoms insuring that atoms at the velocity group selected by the pump are replenished. At the same time ground state hyperfine changing collisions may repopulate the *bright* state which would diminish the effects of pumping. It is hoped that these experiments may shed light on the explanation of anomalous behavior observed in the resonance fluorescence of rubidium in the presence of a perturbing gas.

107. MEASURING THE J/Ψ AT FORWARD RAPIDITIES IN PHENIX

Arbin Timilsina
Iowa State University

Since the discovery of the J/Ψ meson, a bound state of a charm and an anti-charm quark, there have been intensive studies of binding mechanism of the two quarks. As the J/Ψ is composed of two heavy quarks, an understanding of its production would help us understand hadroization in quantum chromodynamics (QCD). Transverse single-spin asymmetries (SSAs) measure the asymmetry of particle production relative to the plane defined by the transverse spin axis and the momentum direction of a polarized hadron. SSAs are excellent probe in understanding QCD dynamics, both through initial-state correlations and process of fragmentation. At the Relativistic Heavy Ion Collider (RHIC), polarized protons are collided to study the spin structure of proton. New measurements utilizing the polar-

ized proton beams at RHIC have discovered a nonzero transverse single spin asymmetry of J/Ψ mesons at forward rapidities. In the presentation I will discuss recent measurements as well as possible upgrades to PHENIX that will allow us to extend these measurements.

108. NANOSCALE SURFACE MODIFICATION OF LAYERED MATERIALS

Aaron O'Shea, Timothy E. Kidd, Kayla Boyle and Laura H. Strauss
University of Northern Iowa

Electron beam lithography is a process of etching micron scale features in a substance using a scanning electron microscope and a resist, in a process similar to acid etching various metals. This process is used in the fabrication of microchips. We have developed a technique that simplifies and expedites this process, without the use of a resist and with an unmodified SEM. Using high energy electrons over a period of time, we are able to modify the surface of transition metal dichalcogenides. These materials are layered like graphite, but have qualities such as resistance to high temperatures which makes them useful as industrial lubricants. This surface modification is visible in the optical, scanning electron, and atomic force microscopes. Our data has revealed the presence of nanoscale particles within the modified region. This process could be a precursor to quantum dots or other nanoscale surface features.

109. MEASUREMENT OF ATOMIC STATE LIFETIMES IN RUBIDIUM AND INELASTIC COLLISION CROSS-SECTIONS IN RUBIDIUM-ARGON

Taylor Buresh and David Olsgaard
Simpson College

Excitation of atomic rubidium by a short (< 1 ns) pulsed laser followed by the observation of time-resolved fluorescence intensity was used to determine excited state lifetimes in rubidium. Resonance observations were made on the four transitions: $5P_{3/2, 1/2} \rightarrow 5S_{1/2}$ and $6P_{3/2, 1/2} \rightarrow 5S_{1/2}$. In the latter two cases, cascade fluorescence involving the $6S$ and $4D_{3/2, 1/2}$ levels were also observed by spectrally resolving fluorescence decay from the $5P_{3/2} \rightarrow 5S_{1/2}$ levels.

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In addition, lifetime measurements of the rubidium $5P_{3/2} \rightarrow 5S_{1/2}$ transition were obtained as a function of argon pressure. Plotting inverse lifetime versus argon pressure (a Stern-Volmer plot) allows us to calculate the Rb-Ar inelastic collision cross-section. A tunable home-built dye laser provided the excitation of the atomic states. The dye laser consisted of an unstirred dye cell transversely pumped by a 2.3 megawatt pulsed nitrogen laser. The dye laser resonator consisted of a 4% output coupler and an 1800 or 2400 lines per mm holographic grating in a Littman configuration.

110. SUPERNOVA REMNANTS: RESULTS FROM SUBORBITAL ROCKETS AND BEYOND

Randall L McEntaffer¹, Phillip Oakley², Webster Cash², Quentin Roper¹ and Thomas Brantseg¹
University of Iowa¹; University of Colorado²

Supernova remnants play a major role in galactic dynamics determining the mass and energy feedback mechanisms within and possibly between galaxies. Studies of these objects lend a wealth of information about the physics of the media involved. The interaction of the supernova blastwave with the interstellar medium creates spectacular imagery as well as rich spectroscopy. I will present recent results on a handful of these intriguing objects. These studies utilize data from a recently launched suborbital sounding rocket as well as the Chandra X-ray Observatory. I will discuss the design and implementation of the rocket payload and its unique ability to observe these objects. Finally, I will present the results of the data analysis and future observation plans.

111. PHOTOMETRIC AND SPECTROSCOPIC STUDIES OF THE ECLIPSING BINARY STAR SYSTEM ALGOL

Jacob David Smith and Kenneth W. McLaughlin
Loras College

We have completed photometry and spectroscopy on the eclipsing binary star system Algol (β Persei) over a period of two months from September to November 2010. The cyclic period inferred from our light curve is in agreement with the previously well-established result. Our spectro-

scopic measurements over a limited wavelength region discern the Doppler shift from only one member, implying either a dominantly massive or luminous partner, or a partner without significant lines in the region studied. The measurement for the transit-time of the eclipse combined with the orbital speed inferred from the Doppler shift allowed estimates of the stellar diameters in agreement with previously published results. Assuming a circular orbit, we can infer the orbital radius for the luminous partner that, combined with estimates from published studies of the orbital radius for the member unseen by us, allow estimates of the mass of the system that are also in agreement with previous results.

112. STORMY (SPACE) WEATHER: AN EMFISIS ON THE RADIATION BELT STORM PROBES

C. A. Kletzing
University of Iowa

The NASA Radiation Belt Storm Probes (RBSP) mission will be launched in 2012 to investigate the dynamic environment of the Earth's radiation belt. The two satellite NASA mission will fly through the Van Allen belts more than 50 years after their discovery with the most comprehensive set of instruments ever deployed in this region of space. Thought for many years to be an essentially solved problem in space science, measurements and theory over the past 15 years have found that, quite to the contrary, the radiation belts are a highly variable part of space that still holds many questions for active research. This talk will present the story of the evolution from mundane to hot research topic, some basics of radiation belt physics, and a brief overview of the RBSP mission including the Electric and Magnetic Field Instrument Suite and Integrated Science (EMFISIS).

113. APPROXIMATION OF JET AXIS IN RAPIDITY SEPARATED DIHADRON CORRELATIONS

Joshua Perry
Iowa State University

The PHENIX detector situated at the Relativistic Heavy Ion Collider at Brookhaven National Laboratory was not de-

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Oral Presentations

115. EXERCISE TRAINING DECREASES THE OCCURRENCE OF CARDIAC ARRHYTHMIAS IN YOUNG AND AGED RATS

Amanda J. Jepson¹, Kathryn C. Welliver¹, Emily R. Garnett², Lauren D. Nawrocki¹ and Julia A. Moffitt¹
Des Moines University¹; Drake University²

The occurrence of cardiac arrhythmias increases with age, although the mechanisms responsible for this effect are poorly understood. Exercise training (ET) has been shown to reduce the incidence of cardiac arrhythmias likely through improved cardiac sympathovagal balance. The goal of this preliminary study was to determine if ET decreases the arrhythmic response to an acute stressor in aged rats. We hypothesized that aging would result in an increased arrhythmic index at rest and during an acute stressor, and that ET would prevent these effects in young (4-6 months) and aged (24-25 months) F344 rats. Rats were subjected to 10-11 weeks of treadmill training or an equivalent sedentary handling protocol. Subcutaneous electrocardiographic (ECG) leads were implanted aseptically at the end of the young sedentary (n=6), young exercise (n=6), aged sedentary (n=4), and aged exercise (n=3) training protocols to allow for ECG data acquisition via the Actiwave telemetry system. The arrhythmic index was calculated during a baseline (BL) period, followed by an acute stressor consisting of sympathetic stimulation through administration of isoproterenol (ISO; 0.15 mg/kg, s.c.), and a brief restraint period. Data indicate that physiological adaptations were consistent with ET as evidenced by an increase in the left ventricular to body weight ratio and a decrease in resting heart rate. Importantly, ET showed a trend toward decreasing the arrhythmic index during BL and ISO in young and aged rats. These preliminary data support the hypothesis that ET provides a protective benefit against sympathetically induced arrhythmo-

signed for forward jet reconstruction. The jet axis approximation method of particle track analysis presented here is an attempt to gain forward jet information in a novel way using the current PHENIX detector. Knowledge of the forward jet axis direction would allow for a measurement of the Collins effect at PHENIX, which would be the first measurement of the Collins effect at a polarized proton-proton collider. Comparing results from this measurement with previous data from Semi-Inclusive Deep Inelastic Scattering (SIDIS) would enable us to gain information on the degree to which factorization is broken in hadronic collisions.

114. ANOMALOUS EMISSION IN THE RESONANCE FLUORESCENCE OF RUBIDIUM IN THE PRESENCE OF ARGON COLLISIONS

Austin Roy and David Olsgaard
Simpson College

Laser induced resonance absorption and fluorescence spectra near 780 nm on the $5S_{1/2} \rightarrow 5P_{3/2}$ transition in rubidium vapor in the presence of an argon perturber are observed. Whereas the absorption spectrum exhibits expected behavior, a strong and unusual modification of the ground state resolved hyperfine fluorescence spectrum is observed, and is found to vary strongly as a function of laser intensity and argon pressure. In particular, in addition to fluorescence emission at the frequencies corresponding to absorption, a spectrally broad emission at a frequency centered half way between the hyperfine absorption frequencies emerges. At sufficient laser power and argon pressure this emission overwhelms the usual hyperfine emission lines. Hyperfine optical pumping and far-wing collisional absorption are believed to play a strong role in explaining this effect. Excitation takes place with a free-running temperature stabilized semiconductor laser operating near 780 nm. The laser is tuned by varying the laser diode injection current using the triangular wave output of an electronic function generator. Sealed Pyrex rubidium vapor cells were used which at room temperature have a rubidium vapor pressure of about $\sim 10^{-6}$ torr. Additional vapor cells used have argon added at pressures of 1, 4, 12, and 40 torr.

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genesis in both young and aged rats. Future studies will address the mechanisms responsible for these effects.

116. PRE-EXERCISE DRINKS AND MUSCLE PERFORMANCE: EFFECTS OF GENDER

Brice Buryanek, Justin Anderson, Dane Larson and Aaron Bunker
Morningside College

The purpose of this study was to examine the effects of pre-exercise drinks on endurance performance. Three males and two females from the ages of 21-28 were used to perform a workout after consuming three different pre-exercise drinks: water, Red Bull, and NO-Shotgun. Water served as our control and was used in comparison to the effects of the commercially available energy drink Red Bull, and the creatine based drink NO-Shotgun. The subjects were scheduled to do one workout a week along with consuming a drink for three different sessions. Three weeks, with a rest period of six days between trials, allowed for the subjects to fully recover from each workout. A combination of a power lab and hand dynamometer was used to measure max contraction, time to fatigue, and averages of each trial. The results showed that both the NO-Shotgun and Red Bull did not increase the maximum muscle contraction in both males and females in both the right and left arms ($p < 0.05$). The results also showed that both the Red Bull and NO-Shotgun did increase the time to muscle fatigue in both arms for males ($p >> 0.05$) and only the left arm for females ($p >> 0.05$). Based on our results, we conclude that Red Bull and NO-Shotgun were found to have significant differential effects on muscle performance in males and females.

117. INVESTIGATION OF SURFACE AREA, VOLUME, AND TEMPERATURE IN HUMAN BODY PARTS

Gary William Fulton
Marshalltown Community College

Factors affecting heat loss from the human body include circulation, insulation, and the surface area to volume ratio of the body part. A simple laboratory experiment in a Human Anatomy & Physiology course investigated the sur-

face area to volume ratio factor using human body parts: index finger, head, and trunk. Students measured the length, width, thickness, and circumference of each body part with metric rulers and metric tapes. Volume was calculated (length x width x thickness) and surface area was calculated (length x circumference) for each body part. Temperature was measured with min-max pin-point thermometers on the index finger pad, in the middle of the forehead, and in the navel. Data from 95 students from 6 semesters were used for analysis. Mean surface area (cm^2) increased from index finger (60) to head (1,700) to trunk (5,700). Mean volume (cm^3) increased from index finger (20) to head (3,900) to trunk (43,000). Mean surface area to volume ratio decreased from index finger (3.0) to head (0.43) to trunk (0.13). Mean temperature ($^{\circ}\text{C}$) increased from index finger (27) to head (30) to trunk (35). Considerable variation occurred among students but volume, surface area, and temperature patterns were consistent for each individual. Although not measured, insulation certainly increased from finger to head to trunk. Decreasing surface area to volume ratio and increasing insulation contribute to the increasing temperature from finger to head to trunk. Heat loss in mammals is directly related to the ratio of the body surface area to body size. As mammals increase in size, the ratio decreases, and metabolic rate (calories per gram per hour) and heat loss decrease. Human body parts show a similar pattern to mammal size.

118. PHYSIOLOGICAL EFFECTS OF *NOTURUS GYRINUS* EXTRACTS ON *MUS MUSCULUS*^{BBB}

Brittany Kuehn and Jeanne Minnerath
Saint Mary's University of Minnesota

Noturus gyrinus, often referred to as the tadpole madtom, is a catfish from the Ictaluridae family. The tadpole madtom produces a toxin associated with the spines of its pectoral fins. This toxin is speculated to serve as a protective mechanism against predators (Binkley, 2000). Previous research has shown that injection of extract from the pectoral fin of the madtom inhibits mobility in both a fish species (*Lepomis gibbosus*) and a mammalian species (*Mus musculus*). The focus of this study was to determine if extracts from other fins of the madtom, or madtom skin

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tissue had the same negative effect on mouse mobility. To do this, extracts from madtom skin and pectoral, caudal, dorsal and pelvic fins were prepared. Mice were injected with the various madtom extracts or saline alone, and mobility was assessed. Results indicated that mice injected with either pectoral or dorsal fin extract exhibited reduced mobility compared to mice injected with the other madtom extracts or saline alone. Since the madtom toxin is exclusively associated with the spines of the dorsal and pectoral fins, this would suggest that the madtom toxin itself was responsible for the reduced mobility observed in this study.

119. SIGNIFICANT DIFFERENCE IN NUMBERS OF BACTERIA ON PAPER CURRENCY FROM A SMALL TOWN BANK AND A LARGE CITY BANK

Krystal Carlson, Katie Matasovsky and Kathleen Arnts
Morningside College

A common concern among many people is the possibility of becoming ill from the bacteria that paper currency carries. *Staphylococcus aureus* is a potentially pathogenic bacteria that can live on human skin and could possibly be transferred to paper currency. Thirty \$1 dollar bills were collected from each a small town and large city bank. These were washed with sterile saline and these saline washes were plated on nutrient agar plates. Some bacterial colonies from these plates were streaked on MSA plates and were gram-stained. There were a low number of bacteria (on average, less than 25 colony-forming units per bill) in the saline washes from experimental dollar bills. The bacteria found on these bills primarily consisted of gram-positive, spore-forming bacilli. The average number of colony forming units per bill was significantly larger for bills from the small credit union versus the large city bank (t-test assuming unequal variances, $p = 0.02$). Since small numbers of bacteria were found on bills, there is little concern for acquiring an infection from money. Most bacteria from the dollar bills were spore forming, which are generally of little concern in terms of causing infections.

120. ARE CELL PHONES VIABLE VEHICLES FOR TRANSMISSION OF BACTERIA CAUSING STREP THROAT?

Kara Yoerger, Selena Miller and Kendra Salter
Morningside College

With the use of cell phones becoming an increasingly necessary tool in society, it is important to consider the potential for cell phones to carry harmful bacteria. *Streptococcus pyogenes* is the causative agent of several infectious diseases, with the most common of these being strep throat. In this study, the possibility that *S. pyogenes* might be spread via cell phones was investigated. Cell phones were inoculated with *S. pyogenes* broth cultures. After 24, 48, and 72 hours the phones were imprinted onto sheep blood agar plates and incubated in 5% CO₂ at 37° Celsius. The plates were then observed for colonies of *S. pyogenes*. Samples from cell phones belonging to confirmed *S. pyogenes* patients were also collected, plated, and observed for *S. pyogenes* colonies. Additionally, a convenience survey regarding cell phone usage (N = 373 respondents) was sent out to obtain statistical data on phone usage. No bacterial colonies indicative of *S. pyogenes* were found on any of the media corresponding to the control phones, experimental phones, or to the samples taken from students' cell phones. Most phone usage did not involve phones touching the users' mouths, and sharing of phones that could have the potential to transmit *S. pyogenes* was rare. Although *S. pyogenes* was not found to be able to survive on cell phone surfaces, other studies have shown that other types of bacteria can survive and possibly be transmitted via cell phone use.

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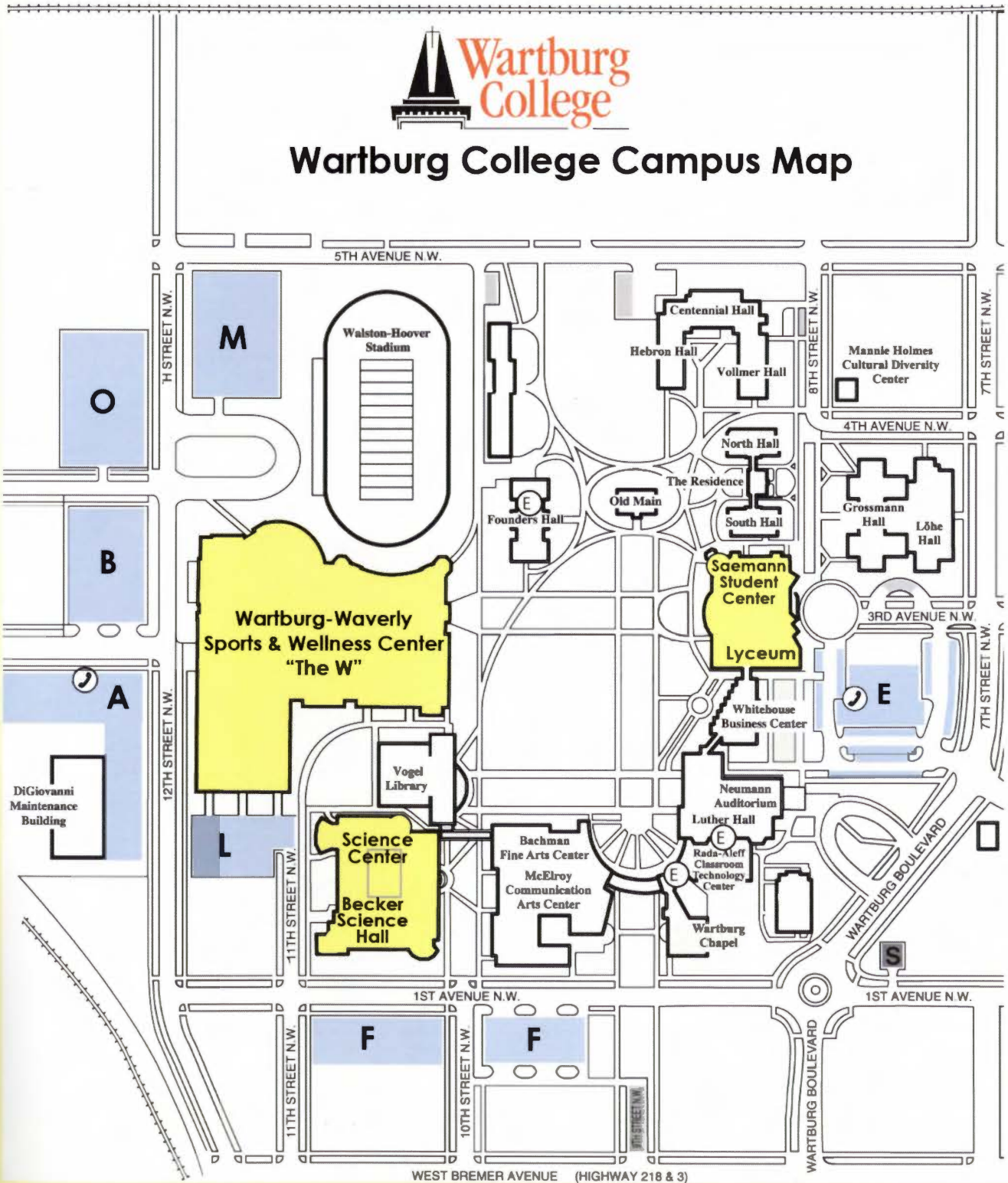
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