

2007


## Proceedings of the 119th Annual Meeting of the Iowa Academy of Science [Program, 2007]

Iowa Academy of Science

*Let us know how access to this document benefits you*

Copyright ©2007, Iowa Academy of Science

Follow this and additional works at: [https://scholarworks.uni.edu/ias\\_docs](https://scholarworks.uni.edu/ias_docs)

 Part of the [Life Sciences Commons](#), [Physical Sciences and Mathematics Commons](#), and the [Science and Mathematics Education Commons](#)

---

# Proceedings of the 119th Annual Meeting of the Iowa Academy of Science



April 27-29, 2007  
Central College  
Pella, Iowa



### **IAS Board of Directors**

Pat Finnerty, President  
Erica Larson, President-Elect  
Paul Bartelt, Past President

### **Directors**

Cliff Chancey  
Gary Donnermeyer  
Deborah Q. Lewis  
Jim Pease  
Lyn Countryman  
Richard B. Hall

### **Local Planning Committee**

Anya Butt, Campus Host  
Russell Benedict, Tri-Beta Host  
Raymond Anderson, GSI

### **Iowa Academy of Science Staff**

Craig Johnson, Executive Director  
Marcy Seavey, Program Director  
Toni Arends, Office Manager  
Jason Gabel, Student Assistant  
Kelsie Schafer, Student Assistant  
Abby Collins, Student Assistant

Iowa Academy of Science  
175 Baker Hall — UNI  
Cedar Falls, Iowa 50614-0508  
319-273-2021  
<http://www.iacad.org>

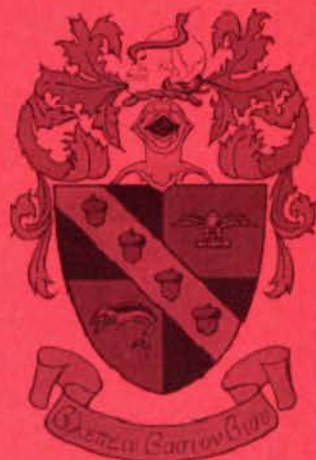
### **Tri-Beta**

This year's Iowa Academy of Science Annual Meeting is being held in conjunction with the District Tri Beta Meeting. Beta Beta Beta (Tri Beta) is a national honor society for outstanding students of biology. Since its founding in 1922, more than 175,000 persons have been accepted into the lifetime membership, and more than 430 chapters have been established throughout the United States and Puerto Rico. District 3 of the North Central Region has 25 chapters in Iowa, Minnesota, and South Dakota. More information on Tri Beta is available on their website, <http://www.tri-beta.org/>.

## **Special Thanks**

The IAS Board of Directors wishes to thank the following organizations and individuals for contributions to the meeting:

Central College  
Central College Science Department  
Marshall Space Flight Center  
National Science Foundation Office of Polar Programs  
Arctic Research Consortium of the U.S. (ARCUS)  
Great Ape Trust of Iowa  
Iowa Natural History Association  
Cedar Falls Utilities  
Geological Society of Iowa  
Cargill, Inc.  
Anya Butt  
Russell Benedict  
Pi Nu Chapter of Tri-Beta  
The Iowa Space Grant Consortium  
Pella Rolscreen Foundation  
Ernie Schiller, Alicia Schiller, Chris Parrish  
Jill Vandervoort & the Pella Chamber of Commerce



# Table of Contents

Welcome from the Executive Director .....	3
Program Summary/Timeline .....	4
Iowa Junior Academy of Science .....	6
General Session Presentations .....	7
Symposia Presentations.....	10
Senior Poster Program .....	14
Awards Luncheon .....	16
President's Banquet .....	16
IAS Annual Business Meeting .....	17
2006-2007 Officers and Volunteers.....	18
Notes.....	19
Field Trips .....	20
Section Meeting Programs and Oral Presentations (Alphabetical by Section) .....	22
Abstracts (by Section) .....	27
Author Index .....	53

Welcome to the 119th Annual Meeting of the Iowa Academy of Science. This year we are pleased to hold our conference on the beautiful campus of Central College. This booklet is your guide to the many presentations and events planned for this meeting. We hope you enjoy your time in Pella and take advantage of the many educational and social opportunities throughout the weekend. If you have questions please stop at the registration desk or ask the IAS staff.

Craig Johnson  
Executive Director

The Iowa Academy of Science is established to further scientific research and its dissemination, education in the sciences, public understanding of science, and recognition of excellent in these endeavors. The Academy has been promoting science throughout Iowa since its establishment in 1875.

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 (AJAS), the Iowa Space Grant Consortium (ISGC), and the Iowa Mathematics and Science Coalition.

# Program Summary

## Friday-April, 27th

Time	Events	Location
7:30-8:15	IJAS Registration and Poster Set-up	Registration Desk
8:00-11:45	Registration Desk Open	Registration Desk
8:00-12:00	USGS Booth	VSC, Outside Room 180
8:00-10:30	Breakfast	VSC, First Floor Hallway
8:15-8:30	Iowa Junior Academy of Science Judges Meeting	VSC, Second Floor Lab
8:30-1:15	Iowa Junior Academy of Science Poster Session	VSC, Second Floor Lab
8:30-10:30	Iowa Junior Academy of Science Oral Presentations	VSC, Rooms 166, 164, 163
9:30-6:00	IJAS Silent Auction Benefit Open for Bidding	VSC, Second Floor Lab
9:30-10:30	Meeting for those interested in the IAS National Wildlife Refuge Audio Program	VSC, Room 170
11:00-11:50	General Session I— <b><i>Launch Vehicles to Enable the Vision for Exploration</i></b> Phil Sumrall, Marshall Space Flight Center	Central Hall, Auditorium
12:00-1:15	Award Luncheon Presentation of IJAS and Excellence in Science Teaching Awards	Graham Conference Center, Banquet Room
1:00-4:45	Registration Desk Open	Registration Desk
1:00-5:00	USGS Booth	VSC, Outside Room 180
1:30-2:15	IAS Business Meeting	VSC, Room 180
1:15-1:45	Iowa Junior Academy of Science Poster Removal	VSC, Second Floor Lab
2:00-4:00	Senior Poster Session Set-up	VSC, Second Floor Lab
2:30-4:30	Symposia (select one): The LEED Program at Central College Development of Sustainable Environmental Technologies Endangered and Protected Species on Protected Lands	TBA VSC, Room141 VSC, Room 180
4:30-6:00	Senior Poster Session, Authors will be at their posters from 4:30-5:30	VSC, Second Floor Lab
5:00-6:00	Social Hour	VSC, Second Floor Lab
6:00-7:15	President's Banquet	Graham Conference Center, Banquet Room
7:30-9:00	General Session II- <b><i>The Role of the Arctic Ocean in Global Climate Change</i></b> , Dr. Dennis Darby, Old Dominion University	Central Hall, Auditorium

# Program Summary

## Saturday-April 28th

Time	Events	Location
8:00-11:45	Registration Desk Open	Registration Desk
8:00-2:00	USGS Booth	VSC, Outside Room 180
8:00-3:00	IJAS Silent Auction Benefit Bidding Open	
8:00-10:30	Breakfast	VSC, First Floor Hallway
8:30-10:45	Section Meetings and Oral Presentations See individual Section Schedules for time and location	VSC, See Individual Section Schedules
10:45	Break	
11:00-11:50	General Session III- <b><i>Beyond Lexigrams: A New Perspective on Bonobo Kanzi's Language Comprehension</i></b> William Mintz Fields, The Great Ape Trust of Iowa	Central Hall, Auditorium
12:00-1:00	Lunch with special guest speaker (12:45-1:00, all welcome) Dr. Mary Schon, Senior Scientist for New Initiatives, Krell Institute, Ames, IA <i>Earthpark: Living Laboratory and Inspiring Classroom</i>	Graham Conference Center, Banquet Room or on your own, see packet for suggestions
1:15-3:45	Section Meetings and Oral Presentations See individual Section Schedules for time and location.	VSC, See Individual Section Schedules
2:00-4:00	Tri-Beta Annual Meeting and Awards	VSC, Room 180
1:30-2:00	Meeting for those interested in the IAS National Wildlife Refuge Audio Program.	VSC, Room 164
2:00- 5:30	Field Trip: GEOLOGIC EXPOSURES NEAR THE RED ROCK DAM VISITOR'S CENTER, JASPER COUNTY, IOWA	Meet in parking lot. Car Pool to site.
3:30-5:30	Field Trip: Great Ape Trust Tour, PREREGISTRATION REQUIRED	Meet at the Great Ape Trust at 3:30
3:30-5:00	Field Trip: Cargill, Inc. Tour, PREREGISTRATION REQUIRED	Meet at Cargill, Inc. at 3:30
5:30- 9:30	Cookout and Bonfire at Lake Red Rock Cabins, Ticket Required, Bat Program after dark, Silent Auction items may be picked up.	Maps Available at Registration Desk

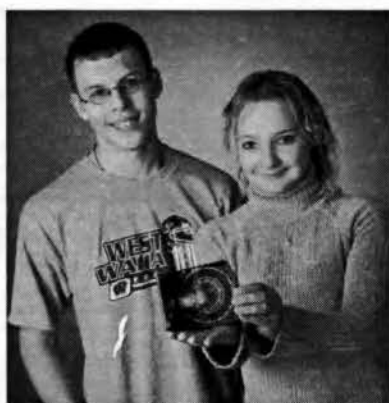
## Sunday-April 29th

8:00-TBA	Tulip Tour	Register at Desk on Friday or Saturday
----------	------------	----------------------------------------

VSC is Vermeer Science Center

# Iowa Junior Academy of Science

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 Iowa Junior Academy of Science Annual Meeting Competition is a long standing tradition. IJAS members who have been awarded a Starr Student Research Grant and Iowa students who have placed at Iowa's regional and state science fairs are invited to compete. Participants bring a stand-alone scientific poster of their project and present a 10 minute oral presentation. 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. IAS covers the cost of



the trip and registration to these meetings. 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 Teacher's Section of IAS, the IJAS Annual Meeting Auction, and board allocated funds. The Iowa Space Grant Consortium has awarded IJAS \$6000 for this years competition with the stipulation that IAS must raise an additional \$6000 or more to add to an IJAS Endowment fund. Your purchases at the IJAS Auction are a part of that match.

The IJAS Posters will be displayed on Friday from 8:00 am to 1:30 pm. The oral presentations will be from 8:30 am-10:30 am. Both sessions are open to all Annual Meeting Participants.

## 2006-07 Starr Student Research Grant Awardees

*IAS Member Frank Starr established the Starr Student Research Grants. IJAS Member students participate in a grant proposal process in order to receive funding to support their individual science fair research. Starrs Grants assist students in gaining access to items not normally available in their science classrooms and provide students with feedback on their research plan by IAS members before they take the project to a Science Fair. This year's awardees are:*

Veronica Arndorfer  
Matthew Boddicker  
Clint Brown  
Rachel Bump  
Haley Burgess  
Michaela Burt  
Gayle Doud  
Lucas Draisey  
J.C. Draper  
Taylor Edgar  
Kelsey Fillman  
Brittani Freesmeier  
Kayla Gilman  
Kelsey Hammer  
Kayla Hasper  
Shala Hawes  
Ethan Henderson

Lee Hunold  
Alicia Keenan  
Deanna Knustrom  
Jordan Lightfoot  
Lauren Linnenbrink  
Trisha Meierotto  
Larry Partlow  
Emilee Rairden  
Angela Ruden  
Maggie Silva  
McKenna Templeton  
Kayla Wagers  
Tony Wagers  
Danielle West  
Brandon Wilson  
Breanne Zumdom  
Shannel Winkel

## 2007 IJAS Annual Meeting Competition Invitees

*The students listed below were invited to compete at this year's conference.*

Heidi Ackelson  
Reed Agne  
Nicolas Aguilar  
Veronica Arndorfer  
Megan Barthlemow  
Matthew Boddicker  
Ryan Brassler  
Clint Brown  
Rachel Bump  
Haley Burgess  
Michaela Burt  
Hannah Dotseth  
Gayle Doud  
Lucas Draisey  
J.C. Draper  
Taylor Edgar  
Kelsey Fillman  
Brittani Freesmeier  
Kelcey Garrett  
Kayla Gilman  
Alexa Groff  
Kelsey Hammer  
Kayla Hasper  
Shala Hawes

Ethan Henderson  
Brianna Hendricks  
Lee Hunold  
Alicia Keenan  
Dylan Keller  
Deanna Knustrom  
Ryan Krafka  
Jordan Lightfoot  
Lauren Linnenbrink  
Trisha Meierotto  
Larry Partlow  
Emilee Rairden  
Sarah Routh  
Angela Ruden  
Shelby Sieren  
Maggie Silva  
McKenna Templeton  
Kayla Wagers  
Tony Wagers  
Danielle West  
Brandon Wilson  
Shannel Winkel  
Breanne Zumdom

# General Session One

## Launch Vehicles to Enable the Vision for Exploration

—Friday 11:00 a.m.

Phil Sumrall, Manager of Advanced Planning, Exploration Launch Projects Office; Marshall Space Flight Center

America is returning to the Moon in preparation for the first human footprint on Mars, guided by the U.S. Vision for Space Exploration. This presentation will discuss NASA's mission today, the reasons for returning to the Moon and going to Mars, and how NASA will accomplish that mission.

The primary goals of the Vision for Space Exploration are to finish the International Space Station, retire the Space Shuttle, and build the new spacecraft needed to return people to the Moon and go to Mars. Unlike the Apollo program of the 1960s, this phase of exploration will be a journey, not a race. In 1966, the NASA's budget was 4 percent of federal spending. Today, with 6/10 of 1 percent of the budget, NASA must incrementally develop the vehicles, infrastructure, technology, and organization to accomplish this goal. Fortunately, our knowledge and experience are greater than they were 40 years ago. NASA's goal is a return to the Moon by 2020.

The Moon is the first step to America's exploration of Mars. Many questions about the Moon's history and how its history is linked to that of Earth remain even after the brief Apollo explorations of the 1960s and 1970s. This new venture will carry more explorers to more diverse landing sites with more capable tools and equipment. The Moon also will serve as a training ground in several respects before embarking on the longer, more perilous trip to Mars.

The journeys to the Moon and Mars will require a variety of vehicles, including the Ares I Crew Launch Vehicle, the Ares V Cargo Launch Vehicle, the Orion Crew Exploration Vehicle, and the Lunar Surface Access Module. The architecture for the lunar missions will use one launch to ferry the crew into orbit on the Ares I and a second launch to orbit the lunar lander and the Earth Departure Stage to send the lander and crew vehicle to the Moon. In order to reach the Moon and Mars within a lifetime and within budget, NASA is building on proven hardware and decades of experience derived from the Apollo Saturn, Space Shuttle, and contemporary commercial launch vehicle programs. Less than one year after the Exploration Launch Projects Office was formed at NASA's Marshall Space Flight Center, engineers are testing engine components, firing test rocket motors, refining vehicle designs in wind tunnel tests, and building hardware for the first flight test of Ares I, scheduled for spring 2009.

The Vision for Exploration will require this nation to develop tools, machines, materials, and processes never before invented, technologies and capabilities that can be turned over to the private sector to benefit nearly all aspects of life on Earth. This new pioneering venture, as did the Apollo Program before it, will contribute to America's economic leadership, national security, and technological global competitiveness and serve as an inspiration for all its citizens.

Phil Sumrall was a junior engineer at NASA's Marshall Space Flight Center in Huntsville, Ala., in the 1960s when he helped build the Saturn V rocket -- the most powerful launch vehicle ever developed -- used by the Apollo Program to take the first humans to the moon. Nearly a half-century later, Sumrall is helping NASA return to the moon -- this time

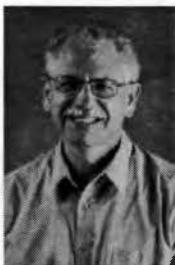
leading development of NASA's next generation heavy-lift launch vehicle. Sumrall, manager of Advanced Planning in the Exploration Launch Projects Office at the Marshall Center, is responsible for development planning for NASA's Ares V launch vehicle and Earth Departure Stage, needed to leave Earth's orbit. Ares V will deliver large hardware and supplies to space for use by exploration missions on the moon and to extend a human presence throughout the solar system.

*A concept image of Ares I, NASA's crew launch vehicle that will carry the Orion capsule with its crews of four to six astronauts to Earth orbit. (NASA/MSFC)*





# General Session Two



## The Role of the Arctic Ocean in Global Climate Change—Friday 7:30 p.m.

Dr. Dennis Darby, Old Dominion University

*Dr. Darby's presentation is sponsored by National Science Foundation Office of Polar Programs and ARCUS.*

The perennial ice cover and freshwater export from the Arctic Ocean are critical components impacting climate change. This talk provides clear evidence of the Arctic as a bellwether for global climate change, e.g., the diminishing sea ice cover; then it discusses the atmospheric phenomenon known as the Arctic Oscillation (AO), which is linked to weather in the Northern Hemisphere, but also is an important factor in ice cover and thus climate change; and it concludes with the role that past AO records have on deciphering this important feature of our global climate system. The AO is a fairly recent discovery, but its close cousin, the North Atlantic Oscillation has been known for some time and its impact on weather is becoming much clearer. Unfortunately, while scientists can describe these oscillations and even predict them for a month or so into the future, the factors that drive them, critical for climate predictions, are not understood. The geologic record, especially the deep-sea record, can serve as a proxy for the AO, allowing us to see how it changed over the past several millennium and explore implications for long-term processes. One such proxy, Fe grain fingerprinting can determine the precise sources of ice floes from the grains entrained by sea ice. These Fe grains record a multi-century to millennial-scale periodic influx of ice from Russian sources into Alaskan waters and these incursions must result from a strongly positive AO. This raises the question of whether there is a link between the atmospheric phenomenon of the AO and millennium-scale processes.

Dennis Darby is Professor of Geological Oceanography in the Department of Ocean, Earth, and Atmospheric Sciences at Old Dominion University, where he has been since 1977. He earned a B.S. in 1966 and an M.S. in 1968, both in Geology, from the University of Pittsburgh and a Ph.D. in Geology and Oceanography in 1971 from the University of Wisconsin, Madison. His research deals with the paleoclimatology and paleoceanography of the Arctic Ocean as determined by fingerprinting iron oxide sand grains using their chemical composition measured by electron microprobe and matching these grains to similar grain types in potential source areas around the Arctic Ocean. Knowing the precise source of each grain provides a detailed picture of the mix of sources for each layer in deep-sea sediment cores and this helps to elucidate the past circulation patterns of drifting ice that transported these grains. It also indicates where glacial ice existed and when this ice calved into the Arctic Ocean. The same technique is used to study modern ice floes and the export of this ice through Fram Strait into the Greenland Sea where it can melt and affect climate.

Dennis Darby is Professor of Geological Oceanography in the Department of Ocean, Earth, and Atmospheric Sciences at Old Dominion University, where he has been since 1977. He earned a B.S. in 1966 and an M.S. in 1968, both in Geology, from the University of Pittsburgh and a Ph.D. in Geology and Oceanography in 1971 from the University of Wisconsin, Madison. His research deals with the paleoclimatology and paleoceanography of the Arctic Ocean as determined by fingerprinting iron oxide sand grains using their chemical composition measured by electron microprobe and matching these grains to similar grain types in potential source areas around the Arctic Ocean. Knowing the precise source of each grain provides a detailed picture of the mix of sources for each layer in deep-sea sediment cores and this helps to elucidate the past circulation patterns of drifting ice that transported these grains. It also indicates where glacial ice existed and when this ice calved into the Arctic. The same technique is used to study modern ice floes and the export of this ice through Fram Strait into the Greenland Sea where it can melt and affect climate.



Dr. Darby is Professor of Geological Oceanography in the Department of Ocean, Earth, and Atmospheric Sciences at Old Dominion University, where he has been since 1977. He earned a B.S. in 1966 and an M.S. in 1968, both in Geology, from the University of Pittsburgh and a Ph.D. in Geology and Oceanography in 1971 from the University of Wisconsin, Madison. His research deals with the paleoclimatology and paleoceanography of the Arctic Ocean as determined by fingerprinting iron oxide sand grains using their chemical composition measured by electron microprobe and matching these grains to similar grain types in potential source areas around the Arctic Ocean. Knowing the precise source of each grain provides a detailed picture of the mix of sources for each layer in deep-sea sediment cores and this helps to elucidate the past circulation patterns of drifting ice that transported these grains. It also indicates where glacial ice existed and when this ice calved into the Arctic. The same technique is used to study modern ice floes and the export of this ice through Fram Strait into the Greenland Sea where it can melt and affect climate.

# General Session Three



## Beyond Lexigrams: A New Perspective on Bonobo Kanzi's Language Comprehension

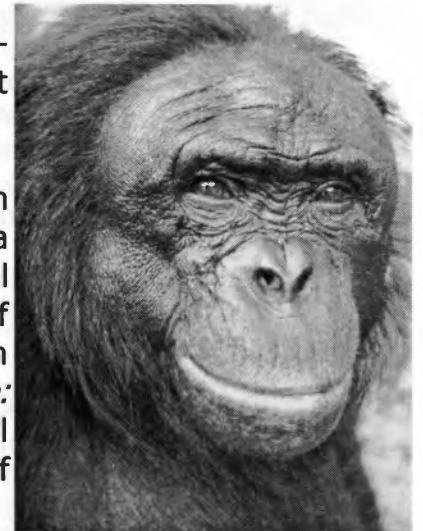
—Saturday 11:00 a.m.

William Mintz Fields, Resident Scientist, Bonobo Research; Great Ape Trust of Iowa

Kanzi, an adult male bonobo chimpanzee at Great Ape Trust of Iowa is the most studied non-human primate in the world. Beginning more than 25 years ago at Georgia State University's Language Research Center and continuing today at Great Ape Trust, Kanzi has demonstrated receptive competence for spoken English, the acquisition of language through the use of abstract symbols known as lexigrams and the ability to make and use Oldowan stone tools. His remarkable abilities have been reported in numerous scientific publications, including *Language Comprehension in Ape and Child* by Sue Savage-Rumbaugh, et al (1993) and *Kanzi's Primal Language* by William M. Fields, et al (2004) and documented by a host of international filmmakers.

At this year's conference, we will look at the historical scientific achievements within the pan/homo culture and where the research at Great Ape Trust will take us in the years to come.

William Fields, a native of Atlanta, began his scientific research with bonobos in 1998 at the Language Research Center (LRC) at Georgia State University in Atlanta where he developed a novel anthropological approach of ape language research. Fields joined Great Ape Trust of Iowa in the spring of 2005. Fields, is coauthor of more than a dozen peer-reviewed scientific publications including *Kanzi's Primal Language: the Cultural initiation of primates into language* with Dr. Par Segerdahl of Uppsala University of Sweden and Dr. Sue Savage-Rumbaugh of Great Ape Trust.



# Symposia

## The LEED Program at Central College

Mike Lubberden, Facilities Management, Central College

Mike Lubberden will lead a tour and discussion of the LEED (Leadership in Energy and Environmental Design) Program at Central College.

The LEED® (Leadership in Energy and Environmental Design) Green Building Rating System™ is a voluntary building certification program that defines high-performance green buildings, which are more environmentally responsible, healthier, and more profitable structures. LEED was created to establish a common standard of measurement for what constitutes a "green" building. LEED serves as a design guideline for green building and offers third party validation of a building's green features.

LEED evaluates buildings in areas: Sustainable Sites, Water Efficiency, Energy & Atmosphere, Materials & Resources and Indoor Environmental Quality. Within these credit areas, points are available and depending on the number of points a project earns determines the level of certification the building will be awarded. There are four progressive levels of certification: Certified, Silver, Gold and Platinum.

Developed by the U.S. Green Building Council, LEED addresses a variety of buildings and building project types through individualized systems, including:

- New Construction
- Existing Buildings
- Commercial Interiors
- Core & Shell
- Homes - in pilot, to be released summer 2007
- Neighborhood Development - in pilot

In addition, LEED application guides are in development to provide information and instruction about applying the LEED rating system to different building types such as Campuses, Retail, Labs, Healthcare and Schools. The application guides will be available in 2007.

LEED rating systems are developed through an open, consensus-based process in USGBC committees. Each volunteer committee is composed of a diverse group of practitioners and experts representing a cross-section of the building and construction industry. Any USGBC member can serve on a committee, and all committee procedures and proceedings are available at [www.usgbc.org](http://www.usgbc.org).

Mike Lubberden has worked in Facilities Management at Central College for 29 years. He began as an HVAC Technician, worked as a Mechanical Trades Supervisor, and is now Director of Facilities Planning and Management. Mike is a member of APPA, a graduate of APPA's Institute for Facilities Management and has attended the APPA Leadership Academy. Mike is the first LEED Accredited Professional in Iowa and a member of the Iowa Renewable Energy Association (IRENEW). He has served on the state DNR's Photovoltaic Advisory Committee. ...He also once received a gold star for a poem he wrote in 3rd grade.

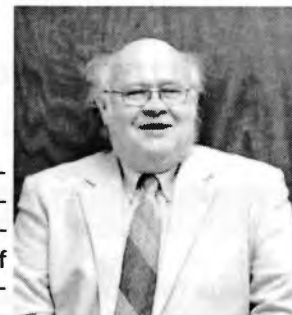
# Symposia

## Development of Sustainable Environmental Technologies

Friday 2:30-4:30 p.m., VSC, Room 141

### **Biomass R&D and Renewable Energy**

David Rusley, Cedar Falls Utilities, Cedar Falls, Iowa



Renewable energy produced from wind is a growing segment of the electric portfolio in Iowa. Definite limits exist that will affect the growth and size of wind generation. The prime wind production sites have already been utilized and installed costs of wind turbines are increasing at a rate ten times faster than inflation. The high voltage transmission grid has had little capital expansion for over 20 years, and the lack of available transmission capacity is a major limiting factor to large additions of new wind generating facilities. Wind is a variable production resource. Wind production patterns often do not meet the hourly requirements of Iowa electric consumers. The storage of wind energy is not commercially economic or technically feasible on a large scale. Iowa annually produces significant amounts of biomass. Much of it is a waste product, such as corn stover (stalks), out hulls, and waste wood. Crops potentially grown for energy production can include switchgrass and prairie grass. Cedar Falls Municipal Utilities (CFU) has been conducting operational research and development to determine if a 43 year old stoker boiler and associated steam electric turbo-generator can be utilized, with few modifications, to turn densified Iowa biomass into renewable electricity. Unlike other efforts, this effort does not blend biomass with coal, but burned as 100% biomass. This provides nearly a 100% reduction on carbon dioxide emissions. Since the supply of biofuel can be stored, the generation of electricity can be scheduled to meet the hourly utilization patterns of Iowa electric consumers. This is a dramatic contrast to the characteristics provided by wind power. Cedar Falls biomass efforts do not require new electric transmission lines to be built. With the assistance and cooperation of the Iowa DNR, CFU has conducted numerous test burns from 2004 thru 2006. The following materials were custom manufactured and successfully burned as a 100% biomass fueled operation burning in pellet form: corn cobs, corn stover, oat hulls, and wood; and in cubed form corn stover and switchgrass. Cedar Falls Utilities has developed the recipes and procedures to produce these densified biofuel products. CFU is now negotiating with potential suppliers of biomass and methods to densify the material into fuel pellets and cubes. The goal is to produce an Iowa produced renewable fuel at a cost similar to that of coal.

### **Beyond Corn Ethanol. Utilization of Biorenewables for Fuels and Chemicals Through Thermochemical Technologies: ISU Experiences**

Justinus A. Satrio, Center for Sustainable Environmental Technologies, Iowa State University



In the past few years interests in using biorenewable materials as resources to substitute fossil fuels for producing fuels and chemicals have increased dramatically. Desires to improve environmental quality and economies of many agricultural regions, the presence of excess agricultural production capacity, and concerns over national security due to over reliance on foreign sources of fossil fuels are some factors that increase the attractiveness of utilizing biorenewables. The soaring price of fossil fuels has helped the production of bioenergy and biobased products to be more favorable economically and increased the level of commercialization significantly. So far, the main focus of biorenewable utilization in the U.S. has been on ethanol, which is mainly produced from corn. It is expected that the production of corn ethanol is 7.5 billion gallons before 2012, which will be a doubling of ethanol production from 2004. Producing fuels from corn only is obviously not enough. It is estimated that if all corn produced in the U.S. is utilized for producing ethanol for fuels, only 12% of the total gasoline consumption will be replaced. Cellulosic materials can dramatically increase the availability of biorenewables as resources for fuels and chemicals. It is estimated that at least 1 billion tons of cellulose (in the form of straw, corn stover, wood wastes, etc) could be sustainably collected and processed in the U.S. each year. This resource is equivalent to 67 billion gallons of ethanol, replacing 30% of gasoline consumption in the U.S. However, the use of cellulosic materials are still challenging due to the complexity of the processes required. Production of cellulosic ethanol based on the biochemical technology, similar to that of corn ethanol, finds challenges mainly in biology and chemistry processing steps. Advancement in biotechnology is needed to improve its efficiency and yields. Thermochemical technologies, which employ elevated temperatures, have gained ground as attractive alternatives to process biorenewable materials. Over biochemical-based technologies, thermochemical technologies have advantages, such as that relatively dirty biomass feedstock can be tolerated and that the lignocellulosic components can be decomposed easily. Thermochemical technologies allow energy integration in the processes, which is also an additional advantage. Iowa State University (ISU) offers a comprehensive research program in thermochemical processing. To be discussed are studies at ISU in gasification, fast pyrolysis, and catalytic and bio-catalytic methods to upgrade synthesis gas from gasification and bio-oil from fast pyrolysis to produce fuels and chemicals. Dr. Justinus Satrio is an Associate Scientist and the Program and Laboratory Manager at Center for Sustainable Environmental Technologies (CSET), ISU. He holds a Ph.D. degree in chemical engineering from ISU and has an extensive research experiences in thermochemical processes, reaction engineering, material and catalysis development, and chemical plant/process design. Prior to pursuing his Ph.D. degree, Justinus worked for several years as a chemical process engineer in the U.S. and in his home country, Indonesia.

# Symposia

## **Endangered and Protected Species on Protected Lands**

Iowa Natural History Association, Friday 2:30-4:30 p.m., VSC, Room 180

### **The Mud Turtles and Other Small Amphibians, Reptiles and Mammals of Big Sand Mound Nature Preserve**

Neil P. Bernstein<sup>1</sup>, James L. Christiansen<sup>2</sup> & Paul Mayes<sup>3</sup>

<sup>1</sup>Department of Biology  
Mount Mercy College  
1330 Elmhurst Drive NE  
Cedar Rapids, IA 52402

<sup>2</sup>Biology Department  
101 Orion Rd,  
Georgetown, Texas 78628

<sup>3</sup>Department of Biology  
East Iowa Community College  
Muscatine, IA 52761

The reptiles, small amphibians and small mammals have been sampled at Big Sand Mound Nature Preserve on a three year rotation for the last 21 years. With the exception of the state endangered mud turtle, all rare species are stable or increasing. Notably, the ornate mud turtle has increased as the mud turtle has decreased. The demography of the mud turtle is indicative of potential extirpation, and several management options are suggested to reverse this trend including: raccoon removal, woody vegetation removal, and enhancing wetlands to former water levels.

### **Macrofungi of Webster County, Iowa: Collections from 1917-1940 and 1980-2006, a comparison**

Rosanne Healy and Lois H. Tiffany

Iowa State University, Ames, IA

Macrofungi are important components of a healthy ecosystem, but there have been few comprehensive surveys of them in Iowa. Therefore, it is difficult to assess any changes in the mycoflora in Iowa. However, a ten-year survey of macrofungi in Webster County reported by F.W. Paige in 1927 presented an opportunity to look for changes in Webster County macrofungi over the past century. Paige collected 379 species, mostly from "woods north of the sanitarium" in Fort Dodge and from Dolliver State Park. We compare data collected prior to 1940 with more recent collections from The Diggings Preserve, north of the old sanitarium and Loomis Park in Fort Dodge, Dolliver State Park, and Woodman Hollow, Brushy Creek and Liska Stanek State Preserves. The number of species collected from early 1900 to 2006 is 939, roughly one third of the total fungal species estimated to occur in Iowa. 30% of the species Paige collected were not collected more recently in Webster County, but were collected elsewhere in Iowa, and we expect to find them in Webster County. Of greater concern are the 20% of species that Paige collected that have not been collected anywhere in Iowa since 1940. Of these, the identity of half are either in question, or are similar enough to more recently described taxa that their identity could be a matter of interpretation. The other 10% are possibly extremely rare, and their status in Iowa is in question. We discuss our survey, with particular emphasis on these "missing" species.

# Symposia

## Endangered and Protected Species on Protected Lands (continued)

### **The Status of Small Mammals of Concern Along the Lower Wapsipinicon River and Implications for Management of Iowa Public Lands**

David McCullough

Biology Department, 100 Wartburg Blvd, Wartburg College, Waverly, IA 50677-0903

Over the past 170 years Iowa has suffered several waves of large-scale habitat destruction and alteration, most involving the conversion to an agrarian landscape. As a result of this loss and fragmentation of habitat, the majority of Iowa's native plant and wildlife communities have been severely impacted. While the loss and decline of many species has been documented, there is a surprising paucity of information concerning a number of organisms, including many we would expect to be relatively common in number and distribution. A small mammal survey was conducted on five publicly owned natural areas along or near the Wapsipinicon River in East Central Iowa (Clinton and Scott counties). Emphasis was placed on noting the presence and status of species of concern in relationship to historic records and predicted distributions, specifically the plains pocket mouse (*Perognathus flavescens*), least shrew (*Cryptotis parva*), southern bog lemming (*Synaptomys cooperi*) and southern flying squirrel (*Glaucomys volans*). Mammals were surveyed by utilizing a combination of methods: live traps, drift fences, remote sensor cameras, and opportunistic observations. The utilization of multiple survey methods increased the likelihood of observing rare, more secretive or difficult to capture species. Historic records for these and other small mammals are rare and sketchy at best. However, results indicate a moderate to severe decline of species of concern within the areas studied. Management implications are discussed.

### **The Status of Protected Butterflies on Iowa's Preserves**

Dennis Schlicht

Iowa Lepidoptera Project

The Iowa Department of Natural Resources lists 2 butterfly species as endangered, 5 species as threatened, and 25 species as special concern. There is a high correlation between the habitats of most of these butterflies and Iowa's state preserves, parks, and wildlife areas. Some listed butterflies are key elements in efforts to identify and set aside areas to preserve biodiversity. The purpose of this analysis is to investigate the status of these species. Two endangered species, one threatened species, and several special concern species have been lost from prairie preserves. Forest and wetland species are faring better.



# Senior Poster Program

## Friday 4:30-5:45

### Cellular, Molecular & Microbiology

- 3. PROMOTER ANALYSIS OF THE ALPHA-AMYLASE GENES IN *ARABIDOPSIS THALIANA***  
C. Buhl, S. Haugen, J. Lytle, R. Muhs, N. Fulk, A. Ahrendsen and K. Leonard
- 4. THE ROLE OF MACROPHAGE TOLL-LIKE RECEPTORS IN ENDOTHELIN-1 (ET-1) PRODUCTION**  
J. N. Divino, A. M. Bjorge and A. Brittingham
- 5. SHINING A LIGHT ON THE EXPRESSION OF HETEROLOGOUS PROTEINS IN ORCHIDS: TWENTY-FOUR HOUR FLOWERS** A. McDonald, E. McDonald, A. Hangartner, J. Gerriettes, J. Rose, D. Moran Portillo, J. Alstott, C. Logan and J. Hampton
- 6. ISOLATION OF YEAST GENES THAT SUPPRESS THE CHROMOSOME LOSS DEFECT OF YAC STABILITY IN MITOSIS MUTANTS<sup>BBP</sup>** B. Ruggle, E. Rusdianto and H. Sleister
- 7. ISOLATION AND CHARACTERIZATION OF THE CYST WALL OF *BODO CAUDATUS*** M. Sease and A. Brittingham
- 8. YAK1, A NOVEL REGULATOR OF YEAST GLYCOGEN STORAGE.** W. A. Wilson and M. P. Boyer

### Ecology & Conservation

- 26. IMPORTANCE OF PATERNAL CARE FOR HATCHING SUCCESS IN FATHEAD MINNOW**  
J. N. Divino and W. M. Tonn
- 27. SUITABILITY OF THE LAKE RED ROCK ENVIRONS AS POTENTIAL HABITAT FOR ZEBRA MUSSELS (*DREISSENA POLYMORPHA*)** E. H. Elkin, E. W. Harris and P. E. Weihe
- 28. STATUS OF THREATENED ARVICOLINE RODENTS IN NORTHEAST IOWA: CORRELATIONS BETWEEN HABITAT QUALITY AND AVAILABILITY** R. Shellabarger and D. A. McCullough
- 29. MONITORING THE IMPACT OF EUROPEAN BUCKTHORN IN TWO FOREST COMMUNITIES IN NORTHWESTERN IOWA** T. T. Tracy, D. Dockter, J. Boersma, E. Vander Broek, R. Weeks and A. Kolb
- 30. THE EFFECTS OF A SPRING BURN ON NOXIOUS WEEDS IN A TALLGRASS PRAIRIE** E. Vander Broek, J. Boersma, R. Weeks and T. T. Tracy

### Engineering

- 41. MEASUREMENT AND CHARACTERIZATION OF OPTICAL NETWORKING DEVICES** K. Meyer, S. Kemmet and M. Mina
- 42. COMPARISON OF BIOREFINERIES BASED ON THE BIOCHEMICAL AND THERMOCHEMICAL PLATFORMS** M. M. Wright and R. C. Brown

### Environmental Science & Health

- 51. APPLICATION OF NITROGEN ISOTOPE TECHNIQUES TO IDENTIFY NITRATE SOURCES IN THE CEDAR RIVER WATERSHED, IOWA** S. Gautam and M. Z. Iqbal
- 52. SURVEY OF FISH FEMINIZATION IN THE MISSISSIPPI RIVER: ESTROGEN EFFECTS ON SEX RATIOS AND VITELLOGENIN LEVELS OF WHITE BASS (*MORONE CHRYSOPS*)<sup>BBP</sup>** S. Knight, A. Wisniewski and C. Hruby

# Senior Poster Program

## Friday 4:30-5:45

### Environmental Science & Health (continued)

- 53. SOYBEAN INDUCED LIGAND EFFECTS ON THE VARIOUS METAL SOLUBILITY** A. McDonnell, P. Schwartz and C. Kim
- 54. SEASONAL VARIATION OF ATRAZINE AND METOLACHLOR CONCENTRATION IN TWO PELLA, IOWA WATERSHEDS<sup>BBP</sup>** R. A. Mino, L. E. Kelderhouse, E. Twining Gerdes and S. Brice
- 55. THE COMBINED EFFECTS OF ATRAZINE AND METOLACHLOR ON THE PRODUCTION OF HARMALA ALKALOIDS IN PASSION FLOWERS<sup>BBP</sup>** K. Schledewitz and C. Haustein
- 56. EVALUATION OF MANURE AS NUTRITIONAL RESOURCES FOR VEGETATION** S. Timmons, B. Bohnsack and C. Kim

### Geology

- 62. QUARTZ GRAIN SURFACE TEXTURES AS AN INDICATION OF INFILLING PROCESSES AND DEPOSITIONAL ENVIRONMENTS ASSOCIATED WITH ICE-WEDGE CASTS IN NORTHEAST IOWA** M. K. Loux and J. C. Walters
- 63. MORPHOMETRY AND RATES OF MORPHOLOGIC EVOLUTION WITHIN THE PENNSYLVANIAN FUSULINID BEEDEINA (ARDMORE BASIN, OKLAHOMA)** S. Reisdorph and J. R. Groves

### Organismal Biology

- 74. USE OF BARNY BY THE INDIANA BAT (*MYOTIS SODALIS*) AND OTHER BATS IN SOUTH-CENTRAL IOWA** R. Benedict<sup>1</sup>, D. Howell<sup>2</sup>, S. Benedict<sup>1</sup>, S. Bonefas<sup>1</sup> and A. Hysell<sup>1</sup>
- 75. EFFECTS OF GENISTEIN EXPOSURE DURING CRITICAL TIME PERIODS ON MATERNAL BEHAVIOR IN SPRAGUE DAWLEY RATS<sup>BBP</sup>** M. K. Caniglia, E. Ball, M. Gombas, S. Knight, B. Widlund and A. Wisniewski
- 76. USING CLOMELON TO IMAGE CHLORIDE DYNAMICS IN TRANSGENIC *CAENORHABDITIS ELEGANS*** N. Rotella, L. Meyer and R. L. Dunbar
- 77. DETERMINING THE ROLE OF GLUTAMATE-GATED CHLORIDE CHANNEL RECEPTORS IN LONG TERM HABITUATION IN *CAENORHABDITIS ELEGANS*** S. N. Wyatt, M. A. Spitz, D. D. Nelson, Z. C. Gernhart, C. B. Peters and R. L. Dunbar

### Physics, Atmospheric & Space Scientists

- 81. WATER ADSORPTION AND UPTAKE IN ATMOSPHERICALLY RELEVANT PARTICLES: ATR-FTIR SPECTROSCOPY AND QCM MEASUREMENTS** J. Schuttlefield and V. H. Grassian

### Physiology & Health Sciences

- 83. EXPOSURE TO GENISTEIN DURING DIFFERENT CRITICAL TIME PERIODS DURING PERINATAL DEVELOPMENT RESULTS IN PHYSIOLOGIC ABNORMALITIES DIFFERENTLY IN MALE AND FEMALE RATS<sup>BBP</sup>** E. R. Ball, M. K. Caniglia, S. Knight, M. Gombas, E. Widlund and A. B. Wisniewski
- 84. EFFECTS OF "CONTEXT" ON PHYSIOLOGICAL RESPONSES TO RACIAL EPITHETS** M. Golnitz, A. Andrews and R. L. Dunbar
- 85. EFFECTS OF CREATINE SUPPLEMENTATION ON MUSCLE FATIGUE AND RECOVERY TIME MEASURED USING GRIP TEST** N. B. Krause, E. L. Whited, L. C. Czyzewicz, C. M. Dirkx, J. L. Staley and R. L. Dunbar



# **Award's Luncheon**

## **Iowa Junior Academy of Science 2007 Awards**

### **Awards**

Two IJAS \$500 Senior Scholarships  
Two Iowa Delegates to the American Junior Academy of Sciences, 2008  
Two Iowa Alternate Delegates to the AJAS, 2008  
Most Promising Young Scientist Award

### **Recognition of all IJAS Members**

## **Excellence in Science Teaching Awards 2007 Awards**

### **Physical Science**

Larry Swinger, West Central Valley, Stuart

# **President's Banquet**

119<sup>th</sup> Annual Meeting of the Iowa Academy of Science

President's Banquet  
Program

President Edward Finnerty, presiding

Dinner  
Introductions

President's Comments – Dr. Edward (Pat) Finnerty

Incoming President's Response – Dr. Erica Larson, President Elect

Craig Johnson, Executive Director

I wonder... IAS New Program for the State of Iowa, Marcy Seavey, Program Director

# IAS Annual Business Meeting

Call Meeting to Order

Introductions

Recognition of Deceased Members and Moment of Silence

Executive Director Report  
Committee Chair Reports

Awards Ceremony  
Induction of new fellows:  
David McCullough and Terry VanCewalle

Announcement of Election Results

Old Business  
New Business

Adjourn

## National Wildlife Refuge Audio Program Project

The Iowa Academy of Science has received a grant from NWR System Preserve America to develop a series of streaming audio/audio downloads for Iowa's seven National Wildlife Refuges. The series will consist of 3 segments for each location (21 in all), each 3-5 minutes long. One segment will focus on the geology of the site, one on the ecology, and one on the history of conservation at the site. All of the segments will be written and narrated by IAS members. David O'Shield, producer of America's Lost Landscape: The Tallgrass Prairie will be the project director and the University of Northern Iowa will provide the sound equipment and recording studio. If you have done research in or have a special interest in one of the refuges, please come to one of the two informational meetings held at this conference or contact the office to become involved.

The NWR project is a stand alone project, however it will also allow us to pilot many of the aspects of the I wonder... Project.

# 2006-2007

## Officers and Volunteers

### **Board of Directors:**

President: Edward Finnerty  
President Elect: Erica Larson  
Past-President: Paul Bartelt  
Director: Cliff Chancey  
Director: Lyn Countryman  
Director: Gary Donnermeyer  
Director: Richard Hall  
Director: Deborah Lewis  
Director: James Pease

### **Committees:**

#### **Conservation and Preserves Committee**

Chair: Laura Jackson

#### **Committees on Committees and Elections**

Chair: Erica Larson

#### **Iowa Science Foundation Committee**

Chair: Andrew Brittingham

#### **Societal Issues Committee**

Chair: Lynn Brant

#### **Student Programs Committee**

Chair: Ernest Schiller

#### **Recognition and Awards Committee**

Chair: Donald Beitz

#### **Anthropology Section**

Chair: Mark Anderson

Vice Chair: Vacant

#### **Cellular, Molecular & Microbiology Section**

Chair: Matthew Henry

Vice Chair: Wayne Wilson

#### **Chemistry Section**

Chair: James Shriver

Vice Chair: David Dozark

#### **Community College Biologists Section**

Chair: Heidi Peterson

#### **Ecology and Conservation Section**

Chair: Daryl Smith

Vice Chair: David McCullough

#### **Engineering Section**

Chair: Albert Ratner

Vice Chair: Thomas Rudolphi

#### **Environmental Science & Health Section**

Chair: Ellen DuPre

Vice Chair: Kavita Dhanwada

#### **Geology Section**

Chair: Anya Butt

Vice Chair: Raymond Anderson

#### **Organismal Biology Section**

Chair: Jim Demastes

Vice Chair: Jean Gerrath

#### **Physics, Atmospheric & Space Sciences Section**

Chair: Cliff Chancey

Vice Chair: Vacant

#### **Physiology and Health Sciences Section**

Chair: Robert Dunbar

Vice Chair: Vacant

#### **Iowa Science Teaching Section**

Chair/President: Gale Vermeulen

Vice Chair/President-Elect: Traci Maxted

Past President: Michael Clough

Secretary: Kathy Lockard

Treasurer: Jeanne Rogis

# Notes

GEOLOGIC EXPOSURES NEAR THE RED ROCK DAM AND JEFFERSON  
VILLAGE CENTER, JEFFERSON COUNTY, IOWA

Map showing the location of the study area in Jefferson County, Iowa.



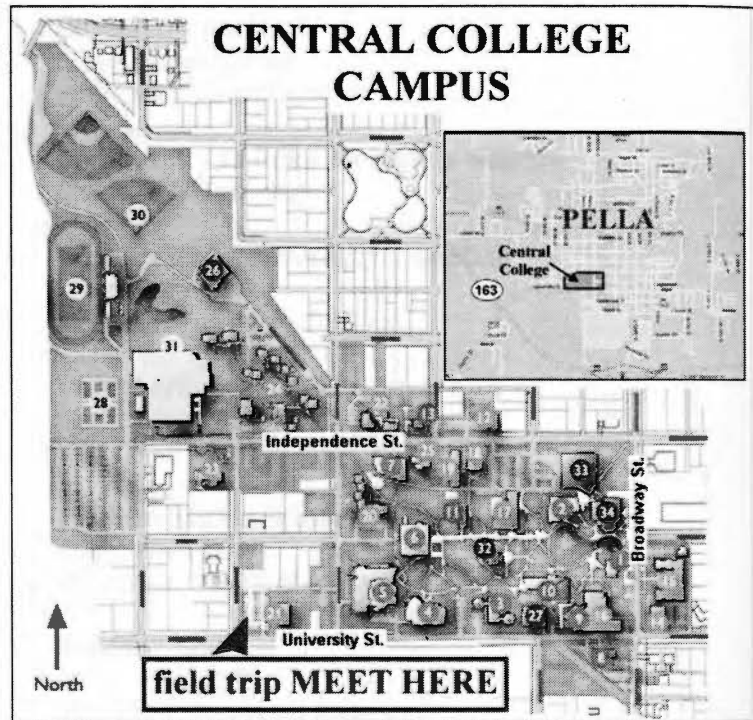
The study area is located in the western part of Jefferson County, Iowa, near the Red Rock Dam and Jefferson Village Center. The geology consists of various sedimentary rocks, including sandstone, shale, and limestone. The Red Rock Dam is a large concrete dam on the Red Rock River, which is a tributary of the Mississippi River. The Jefferson Village Center is a small town with a population of about 100 people. The study area is bounded by the Red Rock River to the west and the Jefferson River to the east. The topography is generally flat, with some low hills in the north. The climate is temperate, with average annual precipitation of about 40 inches. The study area is an important geological site because it contains some of the best exposures of the Jefferson Group, a sequence of sedimentary rocks that was deposited during the late Paleozoic. The Jefferson Group is composed of several formations, including the Jefferson, the Red Rock, and the Jefferson. The Jefferson formation is the most prominent and is characterized by its reddish-brown color. The Red Rock formation is a thin, shaly unit that is well exposed in the Red Rock Dam. The Jefferson formation is a thick, sandstone unit that is well exposed in the Jefferson Village Center. The study area is an important geological site because it contains some of the best exposures of the Jefferson Group, a sequence of sedimentary rocks that was deposited during the late Paleozoic. The Jefferson Group is composed of several formations, including the Jefferson, the Red Rock, and the Jefferson. The Jefferson formation is the most prominent and is characterized by its reddish-brown color. The Red Rock formation is a thin, shaly unit that is well exposed in the Red Rock Dam. The Jefferson formation is a thick, sandstone unit that is well exposed in the Jefferson Village Center.

# Field Trips

## GEOLOGIC EXPOSURES NEAR THE RED ROCK DAM VISITOR'S CENTER, JASPER COUNTY, IOWA

2007 GSI Spring Field Trip, 2:00 p.m. Saturday, Central College Parking Lot Anya Butt, Central College

The 2007 GSI Spring Field Trip will continue the recent practice of following completion of the Geology Session of the Annual Meeting of the Iowa Academy of Science. The field trip will follow completion of the presentation of papers in the Geology Session and a break for lunch. Participants will depart from Central College a parking lot on the southeast edge of the campus (see map) at 2:00 pm. Led by Dr. Anya Butt, Professor of Environmental Studies at Central College, the field trip will examine "Geologic Exposures Near the Red Rock Dam Visitor's Center, Jasper County, Iowa." These exposures include Quaternary Pre-Illinoian glacial drift and younger loess deposits overlying Pennsylvanian Cherokee Group shales, sandstones, limestones, and coals. The units include "classic" cyclothem facies and display variation in facies over a short distance between sections.



Trip participants should gather in the parking lot just west of the University Apartments (building 21 on the map above) on the Central College campus at 812 University Street, for departure at 2:00 pm. The lot should have a sign indicating that it is reserved for us. Hopefully we will be able to collect rocks and fossils, so bring your collecting bag along with your camera, and we will all have a good time.

# Field Trips

## Cargill, Inc. Tour

Eddyville

3:30 p.m. Saturday at Cargill, Inc., **PREREGISTRATION REQUIRED**

Shannon Shriver, Cargill, Inc.

Join a personalized tour of the R & D facility at Cargill, Inc. at Eddyville. The tour will be lead by Shannon Shriver and features a small pilot plant along with fermentation and analytical equipment. Then visit the Acidulants Plant featuring the citric acid product line from fermentation through downstream processing.

Tour members will meet at Cargill, Inc. in Eddyville at 3:30 Saturday afternoon. Reservations are required so be sure to sign up at the registration desk to reserve your spot and pick up a map. The tour is limited to 5 people.

All tour members **MUST** follow the dress code. Sturdy shoes that cover both toe and heel are required. Pants are also required. Tank tops are not allowed. Safety glasses, hard hats, and earplugs are required and will be provided by Cargill. There will be a brief safety training session prior to entering the facility.

## Great Ape Trust Tour

Des Moines

3:30 p.m. Saturday at the Great Ape Trust, **PREREGISTRATIONS REQUIRED**

Great Ape Trust of Iowa Staff

Spend Saturday afternoon visiting the great apes at the Great Ape Trust of Iowa. This exclusive tour has been arranged for the Iowa Academy of Science Annual Meeting. You will meet the Bonobos and learn how Trust scientists are studying them while providing sanctuary and an honorable life. Weather permitting you will visit the Orangutans in their outdoor enclosure. The Great Ape Trust of Iowa is nestled on 200 acres of lowlands, river forest, and lakes in southeast Des Moines.

This tour is limited to 30 people. Please sign up at the registration desk. You will drive on your own and meet at the Trust at 3:30 p.m. Maps are available at the registration desk.



# Section Meeting Programs

## Anthropology Section, VSC, Room 170

- 9:30 1. INTEGRATING THE CHARLES R. KEYES ARCHAEOLOGICAL ARTIFACT COLLECTION CATALOGS INTO THE UNIVERSITY OF IOWA OFFICE OF THE STATE ARCHAEOLOGIST'S ARCHAEOLOGICAL COLLECTION ACCESSION AND SITE RECORD DATABASES <sup>ISF</sup>, S. E. Horgen and J. L. Cordell
- 9:45 2. EXPLORATION OF CULTURAL AFFILIATION AND SITE TYPE IN ALLAMAKEE COUNTY, IOWA, B. Kendall
- 10:00 Section Business Meeting
- 10:45 Adjourn

## Cellular, Molecular & Microbiology Section, VSC, Room 180

- 8:15 9. INSULIN RECEPTOR RESPONSE TO CHROMIUM PICOLINATE IN MURINE MYOBLAST CELLS<sup>BBB</sup>, K. Berg
- 8:30 10. MORPHOLOGICAL ANALYSIS OF NICOTINE-INDUCED CRANIOFACIAL ABNORMALITIES IN ZEBRAFISH<sup>BBB</sup>, K. L. Esbaum, J. L. Simpson and J. Brittingham
- 8:45 11. THE HMG-CO REDUCTASE INHIBITOR SIMVASTATIN DECREASES STAT5 EXPRESSION THROUGH THE INHIBITION OF PROTEIN GERANYLGERANYLATION IN HEMATOPOIETIC CELLS, J. Giles and M. K. Henry
- 9:00 12. SENSITIVITY OF *STAPHYLOCOCCUS AUREUS* AFTER REPEATED SUBLETHAL EXPOSURES OF STELLISEPT SCRUB ANTIMICROBIAL AGENT<sup>BBB</sup>, J. Voight
- 9:15 13. HYPOPHOSPHORYLATION OF THE MASTER CELL CYCLE KINASE CDC28 CAUSES MULTIPLE MORPHOGENETIC DEFECTS IN *SACCHAROMYCES CEREVISIAE*, M. Schmidt, T. Drgon and E. Cabib
- 9:30 14. C4 PHOTOSYNTHETIC EFFICIENCY IN C3 OAT PLANTS CONTAINING MAIZE CHROMOSOMES<sup>BBB</sup>, M. Bilski
- 9:45 15. C4 PHOTOSYNTHETIC ENZYMES ARE LOCATED IN CHLOROPLASTS OF OAT-MAIZE ADDITION LINES<sup>BBB</sup>, A. Deckert
- 10:00 Section Business Meeting
- 10:45 Adjourn for General Session III and Lunch. Resume in same room at 1:15.
- 1:15 16. DETERMINATION OF THE ACTIVITY OF C4 PHOTOSYNTHETIC ENZYMES IN OAT-MAIZE ADDITION LINES<sup>BBB</sup>, K. O'Brien
- 1:30 17. MICROSATELLITE MARKERS FOR MOLECULAR GENETIC ANALYSIS OF *TRIBOLIUM CASTANEUM* POPULATIONS IN A FLOUR MILL, Z. F. Doyungan, J. F. Campbell, S. Kambhampati and R. W. Beeman
- 1:45 18. CYTOLOGICAL ASPECTS OF OAT PLANTS CONTAINING *ZEA MAYS* CHROMOSOMES<sup>BBB</sup>, M. Dant
- 2:00 Adjourn

## **Chemistry Section, VSC, Room 243**

- 9:00 19. THE SYNTHESIS OF ACETEMIDES AND ACRYLAMIDES BY N-ARYLATION OF NITRILES<sup>BBB</sup>, T. R. Applegate and J. A. Shriver
- 9:15 20. UREA-SUBSTITUTED DIAMINOTRIAZINES: A COST EFFECTIVE AND EASILY MODIFIED ANION-BINDING MOTIF, N. L. Bill and J. A. Shriver
- 9:30 Question Session
- 10:00 Section Meeting
- 10:45 Adjourn for General Session III and Lunch. Resume in same room at 1:15.
- 1:15 21. FTIR MONITORING OF SUCROSE INVERSION, S. Shriver, L. Fosdick and E. Staloch
- 1:30 22. OPTIMIZING LED STRUCTURE THROUGH WET ETCHING, D. L. Watkins, J. Olesberg, T. Boggess and M. Arnold
- 1:45 Question Session
- 2:00 23. IMAGING EXOCYTOTIC EVENTS IN PC12 CELLS: A PRECURSOR TO FREE RADICAL STUDIES, I. Nydegger and D. M. Cannon Jr.
- 2:15 24. DEVELOPMENT OF UNIQUE NANOSCALE ARCHITECTURES FOR ENHANCED ELECTROANALYSIS, T. M. Paschewitz and D. M. Cannon, Jr.
- 2:30 Question Session
- 2:45 Adjourn

## **Community College Biologists Section, VSC, Room 143**

- 8:30 Section Meeting
- 10:45 Adjourn for General Session III and Lunch. Resume in same room at 1:15.  
Section Oral Presentations combined with Iowa Science Teacher Section.
- 1:15 25. WEBER-FECHNER LAB EXPERIMENT, G. Fulton
- 1:30 69. EFFECT OF A TEACHER EDUCATION PROGRAM ON PRESERVICE SCIENCE TEACHERS BELIEFS ABOUT TEACHING OF SCIENCE AS INQUIRY, H. Akcay and Z. Yakar
- 1:45 70. PRE-SERVICE TEACHERS SELF-EFFICACY BELIEFS ABOUT HOW TO TEACH AND IMPLEMENT NATURE OF SCIENCE CONCEPT IN SCIENCE CLASSROOM, B. Bezir, J. A. Dunkhase and H. Akcay
- 2:00 71. EVOLUTION EDUCATION AT ISU: STUDENT BELIEFS AND UNDERSTANDING, J. W. Rice and J. T. Colbert
- 2:15 72. SECONDARY SCIENCE PRESERVICE TEACHERS BELIEFS AND PERCEPTIONS , Z. Yakar
- 2:30 73. CHANGE IN TEACHERS IDEAS ABOUT SCIENCE TEACHING AND LEARNING, H. Akcay, B. Bezir and R. E. Yager



## Ecology and Conservation Section, VSC, Room 141

- 8:30 31. REPRODUCTIVE CHARACTERISTICS OF THE ORNATE BOX TURTLE, *TERRAPENE ORNATA ORNATA*, IN EASTERN IOWA, J. Whitman<sup>1</sup>, R. Black<sup>2</sup>, A. McCollum<sup>2</sup> and N. Bernstein<sup>1</sup>
- 8:45 32. CEDAR RIVER MUSSEL RESTORATION PROJECT, T. Brady<sup>1</sup> and L. Anderson<sup>2</sup>
- 9:00 33. FOREST FLOOR MACROINVERTEBRATES AND EUROPEAN BUCKTHORN: IMPLICATIONS FOR INVASIVE SPECIES MANAGEMENT, L. Furlong
- 9:15 34. DEVELOPMENT OF AN INVERTEBRATE-BASED TERRESTRIAL INDEX OF BIOTIC INTEGRITY OF IOWA TALL-GRASS PRAIRIE<sup>BBB</sup>, Orlofske and D. Debinski
- 9:30 35. THE EFFECTS OF VARYING SEEDING RATES OF *BOUTELOUA CURTIPENDULA* AND MOWING ON NATIVE PLANT ESTABLISHMENT IN A NEW PRAIRIE RECONSTRUCTION, R. L. Welch, D. Smith and D. Williams
- 9:45 36. TESTING METHODS TO REDUCE RODENT GRANIVORY IN A PRAIRIE RECONSTRUCTION, C. Hemsath and L. L. Jackson
- 10:00 36. TESTING METHODS TO REDUCE RODENT GRANIVORY IN A PRAIRIE RECONSTRUCTION, C. Hemsath and L. L. Jackson
- 10:45 Adjourn for General Session III and Lunch. Resume in same room at 1:15.
- 1:00 40. DEVELOPING A LAND MANAGEMENT PLAN FOR CENTRAL COLLEGE'S CARLSON-KUYPER FIELD STATION<sup>BBB</sup>, S. Sandberg
- 1:15 37. FLUORINE UPTAKE BY CULTIVATED AND UNCULTIVATED GRASSES, G. A. Skinner, R. J. Leichty and S. H. Emerman
- 1:30 38. IOWA'S SYSTEM OF STATE PRESERVES: CHALLENGES TO CONSERVATION OF BIODIVERSITY, L. L. Jackson and D. Q. Lewis
- 1:45 39. MEASURING ENVIRONMENTAL LITERACY: A NEW SURVEY INSTRUMENT FOR THE MIDWEST, S. R. M. O'Brien, J. L. Pease and F. O. Lorenz
- 2:00 Adjourn

## Engineering Section, VSC, Room 163

- 10:00 Section Meeting
- 10:45 Adjourn for General Session III and Lunch. Resume in same room at 1:15.
- 1:15 43. GENERATION OF PATIENT SPECIFIC MODELS FOR ORTHOPEDIC SURGICAL PLANNING  
S. Tadepalli, K. H. Shivanna, V. A. Magnotta and N. M. Grosland
- 1:30 44. AUTOMATED HEXAHEDRAL MESHING OF ANATOMICAL STRUCTURES USING DEFORMABLE REGISTRATION,  
R. R. Bafna, V. Magnotta and N. Grosland
- 1:45 45. INTEGRATION OF MOTION CONTROL SYSTEM WITH NON-INVASIVE THERAPEUTIC ULTRASOUND, M. M. Heise<sup>1</sup>, T. Long<sup>1</sup>, V. Amin<sup>1</sup>, S. McClure<sup>2</sup> and L. Wu<sup>3</sup>
- 2:00 46. NOVEL COMPOSITE MATERIALS FOR MICROWAVE ABSORPTION, N. L. Fischer and N. Bowler
- 2:15 47. EFFECT OF CROSSLINKING ON THE FRICTION AND WEAR BEHAVIOR OF SOYBEAN AND TUNG OIL-BASED POLYMERIC MATERIALS, S. K. Bhuyan, L. S. Holden, S. Sundararajan and D. Andjelkovic

## Engineering Section, VSC, Room 163 (continued)

- 2:30 Break
- 2:45 48. PRESSURE EFFECTS ON A SINGLE DROPLET IMPACTING ONTO A FLAT SMOOTH SURFACE, I. Karakaya, A. Dix and A. Ratner
- 3:00 49. CFD RESEARCH OF BIOMASS COMBUSTION, X. Zhang and A. Ratner
- 3:15 50. PREDICTION OF SHEAR BAND SPACING IN CHIPS PRODUCED IN METAL CUTTING USING NON-LINEAR DYNAMICS APPROACH, P. Karra, A. C. Bragg and A. Chandra
- Oral Presentation from Physics, Atmospheric and Space Sciences Section
- 3:30 82. RADIO REMOTE SENSING OF THE SOLAR CORONA, S. R. Spangler
- 3:45 Adjourn

## Environmental Science & Health Section, VSC, Room 241

- 8:30 57. CELL CYCLE ANALYSIS OF ATRAZINE-TREATED HUMAN FIBROBLAST CELLS USING FLOW CYTOMETRY, A. L. Austin and K. R. Dhanwada
- 8:45 58. COMPARISON OF PHOSPHORUS LEVELS IN PRECIPITATION IN ADJACENT RURAL AND URBAN AREAS<sup>BBB</sup>, E. Bartusek
- 9:00 59. THE EFFECT OF CADMIUM ON THE MATING BEHAVIOR OF *DROSOPHILA MELANOGASTER*, A. Bixler and F. Schnee
- 9:15 Break
- 9:30 60. EFFECTS OF THE BRUSH CREEK WETLAND COMPLEX ON NITRATE LEVELS FROM THE MONROE WASTE WATER TREATMENT PLANT, J. Bowzer, S. Sandberg, A. J. Christian, C. Haustein and P. Weihe
- 9:45 Section Meeting
- 10:45 Adjourn

## Geology Section, VSC, Room 164

- 8:45 64. AGRICULTURAL CHEMICAL TRANSPORT STUDY, SOUTH FORK IOWA RIVER: OVERVIEW OF GROUND WATER AND HYPORHEIC ZONE INVESTIGATIONS, E. Smith
- 9:00 65. THE ENVIRONMENTAL IMPLICATIONS OF AGGRADATION IN MAJOR BRAIDED RIVERS AT MOUNT RAINIER NATIONAL PARK, WASHINGTON, S. R. Beason
- 9:15 66. ACCELERATED RATES OF FORAMINIFERAL ORIGIN AND EXTINCTION DURING THE LATE PALEOZOIC ICE AGE, J. R. Groves
- 9:30 67. LABORATORY ABRASION OF CRINOIDS: IMPLICATIONS FOR ORIGIN OF THE CHARITON CONGLOMERATE, L. R. Hawkins, M. R. Bennett, R. J. Ellenwood and S. H. Emerman
- 9:45 68. THE NEW IOWA CITY-CLINTON FAULT ZONE AND THE AMANA FAULT ZONE: MAJOR FAULT SYSTEMS IN EASTERN IOWA DELINEATED BY NEW MAPPING, R. R. Anderson and B. J. Witzke
- 10:00 Section Meeting
- 10:45 Adjourn

## Iowa Science Teachers Section, VSC, Room 165

8:30 Section Leadership Meeting

10:45 Adjourn for General Session III and Lunch. Resume in room 143 at 1:15.  
Section Oral Presentations combined with Community College Biologists Section in Room 143.  
See Community College Biologists Section for Oral Presentation Schedule.

## Organismal Biology, VSC, Room 166

- 9:15 78. CALCIUM OXALATE LEAF CRYSTALS AND THEIR MACROPATTERNS IN 45 SPECIES OF PEPEROMIA (PIPERACEAE): ANATOMICAL AND PHYLOGENETIC IMPLICATIONS, H. T. Horner
- 9:30 79. THE EFFECTS OF GREEN TEA ON TADPOLE DEVELOPMENT, M. R. Heber, W. M. Olson and L. A. Beltz
- 9:45 80. SHOOT DEVELOPMENT IN *AMPELOPSIS JAPONICA* [VITACEAE], L. H. Trebbien and J. M. Gerrath
- 10:00 Section Meeting
- 10:45 Adjourn

## Physics, Atmospheric & Space Sciences Section, VSC, Room 170

- 2:45 Section Meeting  
Oral Presentation merged with Engineering Section in Room 163 at 3:30.
- 3:30 82. RADIO REMOTE SENSING OF THE SOLAR CORONA, S. R. Spangler

## Physiology & Health Sciences Section, VSC, Room 269

- 9:00 86. PHARMACOLOGICAL EFFECTS OF THE AQUEOUS EXTRACT OF *CAULOPHYLLUM THALICTROIDES* (BLUE CO-HOSH) ON ISOLATED MUS MUSCULUS UTERI<sup>BBB</sup>, J. Berger and T. DeGolier
- 9:15 87. CHARACTERIZATIONS OF M. TUBERCULOSIS DERIVED PEPTIDE IN CONTEXT OF MULTIPLE HLA ALLELES<sup>BBB</sup>, C. Conway
- 9:30 88. THE EFFECTS WHEY PROTEINS HAVE ON THE ACTIN FIBRILES IN EXERCISED FEMALE *MUS MUSCULUS*<sup>BBB</sup>, A. Karl
- 9:45 89. MEASURING INTENTIONAL BEHAVIOR IN PRIMATES, A. Schnedler, T. Shemak, T. Griggs, S. Boyce and D. Bermingham
- 10:00 Section Meeting
- 10:45 Adjourn

# Abstracts

## (by section)

### Anthropology Section

#### ORAL PRESENTATIONS

#### 1. INTEGRATING THE CHARLES R. KEYES ARCHAEOLOGICAL ARTIFACT COLLECTION CATALOGS INTO THE UNIVERSITY OF IOWA OFFICE OF THE STATE ARCHAEOLOGIST'S ARCHAEOLOGICAL COLLECTION ACCESSION AND SITE RECORD DATABASES <sup>ISF</sup>

S. E. Horgen<sup>1</sup> and J. L. Cordell<sup>2</sup>

*University of Iowa Museum of Natural History<sup>1</sup>, University of Iowa, Office of the State Archaeologist<sup>2</sup>*

The Charles R. Keyes Archaeological Collection is a nationally recognized artifact collection obtained between 1922 and 1948 by Keyes while he served as Director of the Iowa Archaeological Survey for the State Historical Society of Iowa. The Keyes Collection is curated for the State Historical Society of Iowa at the University of Iowa Office of the State Archaeologist (OSA). Archaeological collections such as the Keyes Collection contain untapped reservoirs of scientific information. The challenge is to make these collections, and information about them, available in forms that can be integrated with and compared to other archaeological data. Through an Iowa Science Foundation grant award (ISF-05-03) to the OSA, a project was undertaken to make the Keyes Collection artifact catalogs and associated information contained in "The Keyes Collection: A Finder's Guide" (Tiffany 1981) available to researchers by computerized methods. As a result, this data is now accessible to researchers in a Microsoft Access database that presents the data and links it to associated information in the OSAs collection accession and site record databases.

#### 2. EXPLORATION OF CULTURAL AFFILIATION AND SITE TYPE IN ALLAMAKEE COUNTY, IOWA

B. Kendall

*University of Iowa*

The Iowa Site Record is a collection of forms reporting basic information about every recorded archaeological site in the state. Through an effort to digitize the record and provide geospatial references for each site, it has become an even more valuable tool for addressing archaeological questions. One primary question for archaeologists is the effect of survey bias on the known archaeological record. By comparing the Iowa Site Record to what is expected both archaeologically and ethno-

historically, it is possible to develop a sense of what is missing and what is overrepresented. A second question concerning a broader audience is the effect that archaeological sites could have on the cost of construction and development projects. When used in conjunction with existing GIS probability models for site location, the Iowa Site Record can provide a better idea of the content of potential sites and the effects they would have on building projects. This study explores both survey bias and the effect of prehistoric archaeological sites on construction projects in Allamakee County, Iowa. The results are tailored to archaeologists and project planners to give the known archaeological record a greater potential to inform decision-making that affects Iowa's cultural resources.

### Cellular, Molecular & Microbiology Section

#### POSTER PRESENTATIONS

#### 3. PROMOTER ANALYSIS OF THE ALPHA-AMYLASE GENES IN *ARABIDOPSIS THALIANA*

C. Buhl, S. Haugen, J. Lytle, R. Muhs, N. Fulk, A. Ahrendsen and K. Leonard

*Buena Vista University*

We will present the results of our promoter analysis of the Alpha-Amylase genes I, II, and III from *Arabidopsis thaliana*. The Alpha-Amylase enzymes are responsible for the breakdown of polysaccharides in human digestion and are also thought to digest polysaccharides in plants. Our group has successfully extracted DNA from the plant model, *Arabidopsis thaliana*. We have gone on to design primers specific for each Alpha-Amylase gene and will use these to amplify the promoters of the three genes from the extracted DNA. After amplification, we will fuse the promoters to a green fluorescent protein (GFP)-glucuronidase (GUS) DNA construct. Tissue specific and subcellular expression of these constructs in *Arabidopsis thaliana* will be analyzed using confocal microscopy.

#### 4. THE ROLE OF MACROPHAGE TOLL-LIKE RECEPTORS IN ENDOTHELIN-1 (ET-1) PRODUCTION

J. N. Divino<sup>1</sup>, A. M. Bjorge<sup>2</sup> and A. Brittingham<sup>1</sup>

*Des Moines University<sup>1</sup>, Drake University<sup>2</sup>*

Endothelin-1 (ET-1) was originally characterized as a potent vasoconstrictor secreted by the endothelium. Subsequent analysis has revealed ET-1 to be a multifunctional

peptide produced by a wide variety of cells and tissues under normal and pathological conditions. In addition to its vasoconstrictive properties, ET-1 acts as a mitogen for vascular-smooth muscle cells, modulates the expression of adhesion molecules on endothelial cells, and is a chemoattractant and modulator of immune cell function. The importance of macrophages as a source of ET-1 during infection and inflammation is supported by clinical observations in humans as well as animal models of inflammation. We previously reported the induction of ET-1 production by murine macrophages in response to stimulation with both gram-positive and gram-negative bacteria, as well as in response to TLR4 ligation. Here we demonstrate that purified TLR2 ligands (Zymosan, PAM3CSK4) are also capable of inducing macrophage ET-1 production. Proinflammatory cytokine production following TLR ligation has been reported to require signaling through both the NF-kappaB and MAP kinase signaling pathways. To assess the role of these pathways in macrophage ET-1 production, we have initiated studies to determine the effects of pharmacological inhibitors of these pathways on macrophage ET-1 production. Alone and in combination, specific inhibitors of the ERK, JNK, and p38 MAP kinase pathways suppress LPS induced ET-1 production. Pharmacological inhibition of NF-kappaB nuclear translocation also suppressed LPS induced ET-1 production. These studies support the hypothesis that ET-1 production is part of the characteristic macrophage response to microbial challenge and that macrophages are a key source of ET-1 during infection and inflammation. The production of ET-1 by macrophages during infection and inflammation has the potential to affect tissue perfusion, leukocyte extravasation, and immune cell function.

#### **5. SHINING A LIGHT ON THE EXPRESSION OF HETEROLOGOUS PROTEINS IN ORCHIDS: TWENTY-FOUR HOUR FLOWERS**

A. McDonald, E. McDonald, A. Hangartner, J. Gerriets, J. Rose, D. Moran Portillo, J. Alstott, C. Logan and J. Hampton

*Buena Vista University*

Orchids are a group of flowering monocots belonging to the Orchidaceae family, known for its large number of species and wide array of colored flowers. The purpose of our research is to study gene expression in orchids using fluorescent reporter proteins. Work in our laboratory focuses on inserting various fluorescent protein genes fused to a variety of promoters into the orchid genome. One such fusion is between the cauliflower mosaic virus (CaMV) 35S promoter and the green fluorescent protein gene. Such transgenic orchids will not only elucidate patterns of gene expression in this family of flowering plants but may also be of interest to commercial orchid breeders.

#### **6. ISOLATION OF YEAST GENES THAT SUPPRESS THE CHROMOSOME LOSS DEFECT OF YAC STABILITY IN MITOSIS MUTANTS<sup>BBB</sup>**

B. Ruggle, E. Rusdianto and H. Sleister  
*Drake University*

The eukaryotic cell cycle and processes that maintain genome stability occur with high fidelity. Mutations in genes important for the structure, replication, repair, and/or segregation of chromosomes are correlated with genome instability (i.e., chromosome rearrangements, increased mutation rates, aneuploidy, abnormal chromatin structure, and/or abnormal gene expression). As part of an effort to identify proteins important for genome stability, we previously implemented a genetic screen in the yeast *Saccharomyces cerevisiae* that allows for visual detection of mutants with increased loss of an ADE2-marked yeast artificial chromosome (YAC). This screen resulted in 132 YAC stability in mitosis (ysm) mutants. Three mutants, ysm76, ysm83, and ysm84, have been further characterized for phenotypes related to genome instability. In addition, both high copy and single copy suppressors of these mutants YAC loss defects are being isolated. Identification of these suppressors will contribute to our understanding of protein networks and processes important for eukaryotic genome stability.

#### **7. ISOLATION AND CHARACTERIZATION OF THE CYST WALL OF *BODO CAUDATUS***

M. Sease<sup>1</sup> and A. Brittingham<sup>2</sup>  
*Drake University<sup>1</sup>, Des Moines University<sup>2</sup>*

*Bodo caudatus* is a member of the Order Kinetoplastida. This phylogenetic grouping contains both free living and parasitic protozoa, including parasitic species known to cause disease in man and animals. As a free-living member of this order, *B. caudatus* has been phylogenetically placed as a predecessor of the pathogenic kinetoplastids. During in vitro growth, *B. caudatus* has been observed to transform from a motile, replicating, flagellated form to a dormant, resting, cyst form. This process of cellular differentiation is an attractive model for studying cellular differentiation in this diverse group or protozoa. Here we report the establishment of a system to analyze cellular differentiation in *B. caudatus*. We have developed methods for the isolation of purified populations of both flagellated and encysted forms, and have isolated purified cyst wall fractions. Our analysis of isolated cyst walls reveal two major proteins components of the cyst wall of *B. caudatus*, with approximate molecular weights of 30 and 40 kDa. The identification of cyst wall proteins and the genes which encode them will serve as a model for studying cellular differentiation in free living as well as parasitic (pathogenic) kinetoplastids.

Additional copies of the *Proceedings of the 119th Iowa Academy of Science Annual Meeting* may be purchased for \$10.00. Contact the IAS Office Manager at [iascience@uni.edu](mailto:iascience@uni.edu).

## **8. YAK1, A NOVEL REGULATOR OF YEAST GLYCOGEN STORAGE**

W. A. Wilson and M. P. Boyer  
*Des Moines University*

Glycogen, a branched polymer of glucose, is synthesized by many organisms as a storage form of both carbon and energy. In the budding yeast, *Saccharomyces cerevisiae*, glycogen accumulates prior to entry into the stationary phase of growth in batch culture. The control of glycogen biosynthesis involves regulation of the enzyme glycogen synthase. In yeast, glycogen synthase is encoded by two separate genes, GSY1 and GSY2, with GSY2 encoding the major form of the enzyme. One control of Gsy2p activity involves covalent phosphorylation, which occurs at three C-terminal sites (Ser650, Ser654 and Thr667). We have established that Thr667 is phosphorylated by the cyclin-dependent protein kinase Pho85p in complex with the cyclin Pcl10p. The kinase or kinases responsible for phosphorylation of Ser650 and Ser654 have proven harder to identify. We recovered YAK1 deletants in a high-throughput genetic screen for mutants impacting glycogen storage. YAK1 encodes a protein kinase of the DYRK family. Recently, others have shown that members of the DYRK family of protein kinases phosphorylate and inactivate mammalian muscle glycogen synthase in vitro. Furthermore, this phosphorylation occurs at a site in the muscle enzyme that is closely related in sequence to Ser650 in the yeast enzyme. Related kinases often show related substrate specificity, leading us to hypothesize that Yak1p might represent a novel yeast glycogen synthase kinase. Evidence supporting the role of Yak1p in the control of glycogen storage in budding yeast is presented.

## **Cellular, Molecular & Microbiology Section**

### **ORAL PRESENTATIONS**

## **9. INSULIN RECEPTOR RESPONSE TO CHROMIUM PICOLINATE IN MURINE MYOBLAST CELLS<sup>BBP</sup>**

K. Berg  
*Saint Mary's University of Minnesota*

Chromium picolinate (CrP) supplementation has been studied as a potential therapy for patients with diabetes mellitus, a disease in which the body does not produce or properly use insulin. Research has shown that supplementation of CrP improved the blood glucose and insulin sensitivity in patients with Type II diabetes. It has been proposed that chromium participates in signal amplification as it binds to activated insulin receptors, resulting in stimulation of the receptors tyrosine kinase activity. Cell lysates of cultured rat L6 myoblast exposed to CrP, insulin, or CrP and insulin were analyzed by Western blot. Protein was detected using insulin receptor and phosphorylated insulin receptor antibodies in a chemilumines-

cence system. Proteins were quantified by densitometry. Analysis of these data will be performed by ANOVA.

## **10. MORPHOLOGICAL ANALYSIS OF NICOTINE-INDUCED CRANIOFACIAL ABNORMALITIES IN ZEBRAFISH<sup>BBP</sup>**

K. L. Esbaum, J. L. Simpson and J. Brittingham  
*Simpson College*

The zebrafish, *Danio rerio*, is an excellent model organism for studying vertebrate development. Normal craniofacial formation is dependent on proper proliferation, migration and patterning of neural crest cells in zebrafish and other vertebrate organisms such as humans. We treated zebrafish embryos during the first 24 hours post-fertilization with the teratogen nicotine and analyzed them on the fifth day of development. A variety of gross morphological defects were observed in the treated embryos. Alcian blue staining of the cartilaginous elements revealed severe craniofacial abnormalities that were further characterized by morphometric analysis. Future studies will exploit the well studied genome of zebrafish in an effort to identify the cellular and molecular mechanism of nicotine-induced malformations of the neural crest-derived cartilaginous elements.

## **11. THE HMG-CO REDUCTASE INHIBITOR SIMVASTATIN DECREASES STATS EXPRESSION THROUGH THE INHIBITION OF PROTEIN GERANYLGERANYLATION IN HEMATOPOIETIC CELLS**

J. Giles and M. K. Henry  
*Des Moines University*

The inhibition of 3-hydroxy3-methylglutaryl coenzyme A (HMG-CoA) reductase has multiple recognized beneficial therapeutic effects in addition to lowering cholesterol. HMG-CoA reductase inhibitors (RIs) are under clinical investigation for their therapeutic potential as anti-cancer agents. Here we are interested in the effects of RIs on myeloid cell signal transduction events required for cell survival. Myeloid cell survival is mediated through the activation of cytokine receptors, such as the interleukin-3 (IL-3) and erythropoietin (Epo) receptor. IL-3 and Epo activate Jak2/Stat5, Ras/Erk, and PI3K/Akt signaling pathways. Stat5 has been shown to suppress apoptosis in hematopoietic cells through transcriptional regulation of anti-apoptotic genes of the bcl-2 family. Using cytokine-dependent hematopoietic cells, we demonstrate that cells cultured in the presence of the RI simvastatin ("Zocor") results in a decrease in Stat5 protein expression. This loss in Stat5 expression following simvastatin treatment is due to an impairment in protein prenylation, specifically geranylgeranylation as opposed to farnesylation. Disrupting cytokine-activated Stat5 signaling which regulates myeloid cell survival with inhibitors such as simvastatin implicates potential uses for simvastatin in the treatment of hyperproliferative conditions of myeloid cells, such as leukemia.

## 12. SENSITIVITY OF *STAPHYLOCOCCUS AUREUS* AFTER REPEATED SUBLETHAL EXPOSURES OF STELLISEPT SCRUB ANTIMICROBIAL AGENT<sup>BBB</sup>

J. Voight

*Saint Mary's University of Minnesota*

Pathogenic *Staphylococcus aureus* are carried in the nose and on the skin of a high percentage of the human population. Transmission of pathogenic *S. aureus* is common via the hands of health care personnel. Numerous sources of literature cite *S. aureus* as a species of bacteria that has a history of rapid development of antibiotic resistance. Recently, *S. aureus* resistance has become a problem for hospitals, primarily with the case of Methicillin Resistant *Staphylococcus aureus* (MRSA). In this experiment, a culture of *S. aureus* was repeatedly exposed to sublethal doses of Stellisept Scrub antimicrobial agent in an effort to observe whether the bacteria experienced a decreased sensitivity to the Stellisept Scrub and/or other antimicrobial agents. A sequence of Minimum Inhibitory Concentration (MIC) assays were performed on a culture of *S. aureus*. The MIC was used in this experiment to determine the lowest concentration of Stellisept Scrub necessary to completely inhibit growth of *S. aureus*. Various concentrations of Stellisept Scrub antimicrobial agent were added to a known quantity of *S. aureus*. Bacteria that survived exposure to the antimicrobial agent were re-cultured and used in subsequent MIC assays. Over time greater concentrations of Stellisept Scrub were necessary to completely inhibit growth of *S. aureus*, indicating a decrease in sensitivity. Kirby-Bauer Assays were utilized to compare *S. aureus* repeatedly exposed to Stellisept Scrub with unexposed stock *S. aureus*. The Kirby-Bauer Assay measured bacterial sensitivity of Stellisept Scrub-exposed and unexposed *S. aureus* to antibiotics. A variety of antibiotic disks were used to compare antibiotic sensitivity between the exposed and unexposed bacteria. There were no significant differences in the zones of inhibition, indicating that repeated exposure to sublethal concentrations of Stellisept Scrub did not cause decreased antibiotic sensitivity in *S. aureus*.

## 13. HYPOPHOSPHORYLATION OF THE MASTER CELL CYCLE KINASE CDC28 CAUSES MULTIPLE MORPHOGENETIC DEFECTS IN *SACCHAROMYCES CEREVISIAE*

M. Schmidt<sup>1</sup>, T. Drgon<sup>2</sup> and E. Cabib<sup>2</sup>

*Des Moines University<sup>1</sup>, National Institutes of Health<sup>2</sup>*

We isolated a yeast strain with an extremely aberrant morphology in a screen for mutants with defective cell walls. The mutant cells exhibited multiple elongated and misshaped buds and were prone to osmotic lysis. The mutation was found to reside in *Cak1*, a gene coding for a Cdc28-activating kinase. Cdc28 is the master cell cycle kinase, which is regulated by multiple mechanisms. Among these regulatory mechanisms is association with cell-cycle specific cyclins, inhibitory phosphorylation at Tyr9 and activating phosphorylation on Thr168, the latter

provided by the Cak1 kinase. The Cak1 kinase is an essential enzyme unique to ascomycete fungi. Partial loss of Cak1 activity leads to a loss in Cdc28-activity, causing multiple cell-cycle defects. We found that a *cak1* mutation causes hyperpolarized growth which affects cell wall integrity and septum formation after cytokinesis. In contrast to other cell cycle defects causing hyperpolarized growth, a Cak1 mutation cannot be suppressed by removing the inactivating phosphorylation of Cdc28. Thus, the Cak1 cell wall defects are caused by a novel mechanism. We propose that in a Cak1 mutant, a loss of Cdc28-activity during the G2/M transition of the cell cycle causes hyperpolarization of the cytoskeleton, followed by hyperpolarized growth. It appears that a hyperpolarized secretion pattern leads to apical deposition of new cell wall material, which renders the lateral cell walls fragile and prone to rupture during mechanical or osmotic stress. A hyperpolarized growth pattern also leads to a disturbance in bud neck assembly followed by delays and problems in septum construction.

## 14. C4 PHOTOSYNTHETIC EFFICIENCY IN C3 OAT PLANTS CONTAINING MAIZE CHROMOSOMES<sup>BBB</sup>

M. Bilski

*Saint Mary's University of Minnesota*

The University of Minnesota developed oat plants containing individual maize chromosomes in order to physically map the maize genome. Questions arose regarding the effect of maize chromosomes on the photosynthesis of these oat plants. Oat is a C3 plant and maize a C4 plant. C4 photosynthesis is more efficient in adverse conditions, and C4 plants can survive in low CO<sub>2</sub> concentrations. Oat and maize plants, as well as different oat-maize chromosome lines were placed in a sealed growth chamber where the plants were forced to compete for the CO<sub>2</sub> in the chamber. In numerous trials, maize consistently survived much longer than oat and oat-maize chromosome lines. In order to quantify this study, the CO<sub>2</sub> compensation point was measured using an LI-6400 gas exchange system. A low CO<sub>2</sub> compensation point is indicative of C4 photosynthesis and a much higher compensation point is indicative of C3 photosynthesis. The tests showed that no oat plants, normal or addition lines, had CO<sub>2</sub> compensation points characteristic of C4 photosynthesis. However, an oat-maize addition line containing maize chromosomes 6 and 9 did show a significantly lower CO<sub>2</sub> compensation point than normal oats. Another important characteristic of C4 plants is suberin, a waxy material that aids in preventing photorespiration that causes decreased efficiency in C3 plants. A staining technique specific for suberin was developed, and it was clearly observed in maize and oat-maize chromosome line 4, but not in normal oats. The rates of photosynthesis were also investigated using a Gilson respirometer, and it was determined that several oat-maize chromosome lines had a higher rate of photosynthesis than normal oat. Taken together, it appears that some C4 characteristics are observed in oat-maize addition lines.

## **15. C4 PHOTOSYNTHETIC ENZYMES ARE LOCATED IN CHLOROPLASTS OF OAT-MAIZE ADDITION LINES<sup>BBB</sup>**

A. Deckert  
*Saint Mary's University of Minnesota*

The laboratories of the University of Minnesota have produced oat-maize addition lines that consist of oat plants with one or more maize chromosome incorporated into the oat genome. Due to the difference in photosynthetic processes between oat, a C3 plant, and maize, a C4 plant, the addition lines allow for the study of how chromosome transgenics might affect the photosynthesis of a plant. Previous research at Saint Mary's University of Minnesota has found that the enzymes critical for C4 photosynthesis, pyruvate orthophosphate dikinase (PPDK) and phosphoenol pyruvate carboxylase (PEPc) are present and active in the maize chromosome 6 and 9 addition lines, respectively. The objective of this research project was to determine whether these critical C4 photosynthetic enzymes (PPDK and PEPc) are located in the chloroplasts, where much of C4 photosynthesis occurs, and not just in other parts of the cells in leaf tissue. To do this, chloroplasts were isolated from leaf tissue of the oat-maize addition lines using a Percoll gradient. In situ immunocytological enzyme localization was then conducted on these preparations. Results were analyzed with bright field microscopy. Results showed a considerable positive response to the antibody against PPDK in the oat-maize 6 addition line and to the antibody against PEPc in the oat-maize addition line.

## **16. DETERMINATION OF THE ACTIVITY OF C4 PHOTOSYNTHETIC ENZYMES IN OAT-MAIZE ADDITION LINES<sup>BBB</sup>**

K. O'Brien  
*Saint Mary's University of Minnesota*

Oat-maize addition lines were generated in laboratories at the University of Minnesota in order to physically map the maize genome. These addition lines are oat plants that contain one chromosome from maize. This allows for the study of how chromosome transgenic affects the photosynthesis of the plant. Previous research at Saint Mary's University of Minnesota has shown that the C4 photosynthetic enzyme phosphoenolpyruvate carboxylase (PEPc) is active in the oat-maize 9 addition line, and that the C4 enzyme pyruvate orthophosphate dikinase (PPDK) is active in the oat-maize 6 addition line. Malate dehydrogenase (MDH), malic enzyme (ME), and (in some cases) aspartate aminotransferase (AAT) are three additional enzymes that are critical to C4 photosynthesis. Enzyme assays indicated these three enzymes are all active in oats and each of the oat-maize addition lines. Therefore, the potential exists that all the enzymes crucial to C4 photosynthesis would be active in a plant containing both chromosome 6 and chromosome 9. Recently, oat-maize 6 + 9 addition lines were successfully generated at the University of Minnesota. Assays were conducted for the C4

enzymes PEPc and PPDK using protein extracts from these plants. The 6 + 9 addition lines showed significantly lesser PPDK activity than the oat-maize 6 addition line. The results from the PEPc assays indicated no significant difference in activity between oat-maize 6 + 9 addition lines and the oat-maize 9 addition line.

## **17. MICROSATELLITE MARKERS FOR MOLECULAR GENETIC ANALYSIS OF *TRIBOLIUM CASTANEUM* POPULATIONS IN A FLOUR MILL**

Z. F. Doyungan<sup>1</sup>, J. F. Campbell<sup>2</sup>, S. Kambhampati<sup>3</sup> and R. W. Beeman<sup>2</sup>

*Graceland University, Division of Science and Mathematics<sup>1</sup>, United States Department of Agriculture, Grain Marketing and Production Research Center, Agricultural Research Service, KS<sup>2</sup>, Kansas State University, Department of Entomology, KS<sup>3</sup>*

The red flour beetle, *Tribolium castaneum*, is a major pest of flour mills. Using molecular markers, we tried to address the questions about *T. castaneum* population structure, sources of infestation and mechanisms of population rebound after fumigation. Beetles for DNA fingerprint analysis were collected in live traps over the course of four years from multiple locations within a commercial flour mill in Kansas. Regions in the *Tribolium* genome containing tri- and di-nucleotide repeat motifs were identified from the literature, BAC-end sequence libraries, and initial data from the genome sequencing project were used for designing primers. Polymorphism in these microsatellite-harboring regions is being analyzed.

## **18. CYTOLOGICAL ASPECTS OF OAT PLANTS CONTAINING *ZEA MAYS* CHROMOSOMES<sup>BBB</sup>**

M. Dant  
*Saint Mary's University of Minnesota*

The principal goal of this project was to determine whether cytological aspects change in oat plants when a *Zea mays* (maize) chromosome was added to the plant. The University of Minnesota provided the oat-maize chromosome addition lines. An oat-maize addition plant is an oat plant containing a maize chromosome in its genome. The plants were grown under greenhouse conditions and PCR was used to confirm the presence of maize chromosome. Leaf sections were made using a cryostat microtome. Microscopy and an image analysis were used to examine the tissue. Chlorophyll extractions were also made and measured for content with a spectrophotometer. A cytophotometer was used to measure transmittance of the leaf tissue. The results showed that the oat-maize line with maize chromosome 3 (OM-3) grows taller with the leaves projecting horizontally and with larger auricles more like maize at the attachment of the leaf to the stem. Cell density was greater, and chloroplasts were also larger in the OM-3 line. The vascular bundles were spaced closer together in the OM-3 line more indicative of the maize. Chlorophyll content of the OM-3 line, however, was not significantly different from normal oat. A relation-



ship to OM-3 can be found with Golden 2 maize that is due to a mutation on chromosome 3. This mutant strain does not have bundle sheath cells like normal maize, and it showed decreased chlorophyll synthesis. Trends showed the transmittance of leaf tissue of OM-3 to be the lowest, indicating the greatest cell density. Taken together, these observations indicated that maize chromosome 3 may be involved in these particular cytological traits.

## Chemistry Section

### ORAL PRESENTATIONS

#### 19. THE SYNTHESIS OF ACETEMIDES AND ACRYLAMIDES BY N-ARYLATION OF NITRILES<sup>BBB</sup>

T. R. Applegate and J. A. Shriver  
*Central College*

Acetonitrile is a common compound used as a solvent for many reactions in organic chemistry. It is also commonly used as a solvent for HPLC in analytical and industrial applications. It possesses electrophilic qualities and rarely if ever does one consider acetonitrile as a nucleophilic reagent. However, with a very strong electrophile and in the absence of competitive nucleophiles, this reaction can indeed take place. Under the appropriate conditions the thermal decomposition of benzenediazonium salts into a short-lived aryl cation has been shown to occur. If this decomposition is affected in the presence of a compound such as acetonitrile or acrylonitrile, N-arylation does occur to give the corresponding amide. In this study, a series of substituted benzenediazonium salts were decomposed in neat acetonitrile or acrylonitrile to yield their corresponding N-arylated amides. In most cases, purification by flash chromatography gave rise to in moderate yields.

#### 20. UREA-SUBSTITUTED DIAMINOTRIAZINES: A COST EFFECTIVE AND EASILY MODIFIED ANION-BINDING MOTIF

N. L. Bill and J. A. Shriver  
*Central College*

A versatile one-step synthesis of urea-substituted diaminotriazines is described. In this process, two commercially available 2,6-diamino-1,3,5-triazines were reacted with a variety of isocyanates to give a novel system capable of donating up to four strong hydrogen bonds under acidic conditions. This reaction proceeded under relatively moderate conditions (50°C in THF) in the absence of a tin catalyst. The product was easily purified by filtration, using diethyl ether to wash the precipitate. This produced a product that was pure as determined by its <sup>1</sup>H NMR spectrum in DMF. Though the solubility of this system is poor in most solvents (only soluble in DMF), the long term goal is to prepare a polymer containing this functionality. Basic anion binding studies of this system to mono-, di- and triphosphate systems are currently underway.

#### 21. FTIR MONITORING OF SUCROSE INVERSION

S. Shriver<sup>1</sup>, L. Fosdick<sup>1</sup> and E. Staloch<sup>2</sup>  
*Cargill Acidulants<sup>1</sup>, Iowa State University<sup>2</sup>*

Sucrose undergoes an inversion reaction, yielding glucose and fructose. Some fermentation processes require inversion to make the sugars usable by microorganisms. High performance liquid chromatography (HPLC) is the most common method for monitoring the inversion of sucrose to glucose and fructose. Fourier Transform Infrared (FTIR) spectrometry is an attractive alternative to HPLC for cost and time considerations. Unlike NIR (Near Infrared) spectrometry, FTIR is a primary technique, where absorption bands are specific to the species are measured. We have demonstrated that glucose and sucrose can be differentiated by FTIR, and instrument response is linear for aqueous solutions of sucrose, glucose and fructose with concentrations ranging from 0 to 100 grams per liter. Analytical considerations comparing the HPLC and FTIR methods will be presented.

#### 22. OPTIMIZING LED STRUCTURE THROUGH WET ETCHING

D. L. Watkins, J. Olesberg, T. Boggess and M. Arnold  
*University of Iowa*

We are interested in the construction of a solid-state near infrared spectrometer designed for measuring glucose and other biomolecules in biological fluids. This solid-state spectrometer consists of a broadband light emitting diode (LED) light source coupled with an optical sampling chamber, linear variable optical filter and array of photodetector elements. In operation, incident light from the LED source passes through the sample while it flows through the sample chamber. Transmitted light then passes through the linear variable filter before being detected by the detector array. High quality spectra are required for acceptable analytical results. Performance of our steady-state spectrometer depends heavily on the radiant powers produced by the LED light source. The wavelengths of light needed for the measurement of glucose range from 2.0 – 2.5 μm, which constitutes the combination region of the near infrared spectrum. Light at these wavelengths can be produced from semiconductor structures of GaInAsSb quaternary materials. Composition and doping of these semiconductor materials and the physical structure of the material itself are two parameters that are critical in designing LED's with high radiant powers for near infrared spectroscopy.

This presentation will focus on efforts to develop etching conditions to provide the physical structures needed to optimize the harvesting of light generated by the LED. Although etching conditions are well known for similar semiconductor materials, such as Si and GaAs, little is published for the GaInAsSb materials. We are investigating wet etching conditions to produce well defined angles within the semiconductor material with the objective of directing more of the radiant power toward the collection

optics. An anisotropic etch is under development to produce flat sidewalls with a truncated inverted pyramid shape. A mixture of citric acid, hydrochloride acid and hydrogen peroxide is used to provide these surfaces. The relationship between the composition of the etching solution and the physical dimensions of the resulting structure will be presented. Optimal conditions will be identified and results will be viewed through a series of optical and scanning electron micrographs.

### **23. IMAGING EXOCYTOTIC EVENTS IN PC12 CELLS: A PRECURSOR TO FREE RADICAL STUDIES**

I. Nydegger and D. M. Cannon Jr.

*University of Iowa*

Free radicals (including reactive oxygen and nitrogen species) have been implicated in most major neurological diseases and disorders such as: ischemia-reperfusion injury (stroke), amyotrophic lateral sclerosis (ALS), Alzheimers and Parkinson's, AIDS dementia and other dementias as well as cardiovascular diseases. Free radicals, however, are not always detrimental in the body as commonly perceived. Previous work also suggests that in addition to the traditional neurotransmitters that are released during exocytosis (such as dopamine), free radicals are also implicated as neuronal messengers. Studies have shown that free radicals are produced during neurotransmitter degradation such as dopamine autooxidation that occurs during exocytosis. This study seeks to elucidate the process of exocytosis in PC12 cells using fluorescence microscopy.

### **24. DEVELOPMENT OF UNIQUE NANOSCALE ARCHITECTURES FOR ENHANCED ELECTROANALYSIS**

T. M. Paschkewitz and D. M. Cannon, Jr.

*University of Iowa*

Miniaturization in the field of analytical chemistry continues to advance measurement capabilities in the biomedical sciences by enlightening our knowledge of complicated biological systems. Novel nanoelectrode fabrication technologies have been developed that will provide higher spatial and faster temporal measurement of small molecules associated with cellular function, specifically, those involved in neuronal communication. We have developed a method using focused-ion beam (FIB) to mill through insulating layers of poly(methyl methacrylate) (PMMA) to fabricate nanoelectrode templates. FIB milling is a technique that provides to precise spatial control of nanoscale fabrication. Such control allows for fabrication of single pore electrode templates as well as multiple pore array templates. Enhancement of spatiotemporal resolution is a direct result of restricted diffusion and molecular confinement at nanoscale electrochemical elements. Pure radial diffusion at electroactive elements of fabricated arrays can be achieved by precise control of spacing, size, and density of nanopores milled in the array template. In situ characterization of these templates and electrode architectures is performed using SEM imaging. Nanoelectrode

arrays (NEAs) and single nanoelectrodes are further studied using cyclic voltammetry and ultra sensitive optical microscopy. Initial cyclic voltammetric data using single nanopore template constructs shows promise for this method of accessing nanoscale electrochemistry. Optimization of this system lends itself to eventual integration into nanofluidic devices and coupling with lithographic techniques to increase spatial control for electrogenerated chemiluminescent events and single cell handling and analysis.

## **Community College Biologists Section**

### **ORAL PRESENTATIONS**

#### **25. WEBER-FECHNER LAB EXPERIMENT**

G. Fulton

*Marshalltown Community College*

In the 1800's Ernst Weber and Gustav Fechner conducted research relating physical stimuli to sensation and perception, beginnings of psychophysiology. A simple lab experiment demonstrates the relationship of the perception of added stimulus weight to the initial stimulus intensity. Graduated beakers of different initial weights are suspended one at a time from a blindfolded student's index finger. Water is slowly added until the student feels an increase in the weight (the just-noticeable-difference). The volume of water is directly converted into grams. An Intensity Difference fraction is calculated by dividing the added weight of water by the initial weight. Initial weights of graduated beakers are 10g, 30g, 90g, 270g, and 810g. Students graph Final Weight, Just-Noticeable-Difference Weight, and Intensity Difference Fraction against the Initial weight. Results demonstrate that as the initial stimulus increases (increasing Initial Weight), the weight of added water (Just-Noticeable-Difference) also increases, but at a decreasing ratio (Intensity Difference Fraction).

### **Inspire future scientists!**

Next year volunteer to be a judge for the Iowa Junior Academy of Science Competition. Contact the IAS Office at [ias-science@uni.edu](mailto:ias-science@uni.edu) for more information.

# Ecology & Conservation Section

## POSTER PRESENTATIONS

### 26. IMPORTANCE OF PATERNAL CARE FOR HATCHING SUCCESS IN FATHEAD MINNOW

J. N. Divino<sup>1</sup> and W. M. Tonn<sup>2</sup>

*Des Moines University<sup>1</sup>, University of Alberta<sup>2</sup>*

By increasing egg survival, parental care can subsequently impact year-class strength and overall dynamics in fish populations. In several freshwater species, breeding males provide solitary nest care, cleaning the eggs and protecting them from predators. To quantify the importance of paternal care for hatching success, we introduced populations of fathead minnow (*Pimephales promelas*) into experimental ponds in Alberta, Canada that contained nesting substrate. In the 150 nests examined over two spawning seasons, hatching success averaged 39%, but was highly variable. Nests where paternal care was observed were larger, lasted longer, and produced more hatchlings than unguarded nests, which often failed. Hatching success further increased if male caregivers displayed agonistic behaviors towards nest intruders. Larger breeding males were more likely to be aggressive and typically nested earlier than smaller males. Because progeny with earlier hatch dates often have higher first-year survivorship, larger males may contribute disproportionately more offspring to populations than late-spawning smaller males. However, evidence of post-spawning mortality revealed that costs were associated with vigilant paternal care.

### 27. SUITABILITY OF THE LAKE RED ROCK ENVIRONS AS POTENTIAL HABITAT FOR ZEBRA MUSSELS (*DREISSENA POLYMORPHA*)

E. H. Elkin, E. W. Harris and P. E. Weihe

*Central College*

Although well-established in other areas, to date the invasive Zebra Mussel (*Dreissena polymorpha*) has not colonized Iowa's largest lake, Lake Red Rock. We conducted a study to evaluate habitats in and near the lake, comparing their water chemistry, physical parameters, and general ecological condition with results from other water bodies containing Zebra mussels. Six sites were sampled twice each in October 2006: four sites in the lake, one downstream in the Des Moines River, and one in Robert's Creek Park, a sub-watershed reservoir of Red Rock. The habitats included riverbank, boat ramps, and associated structures, each ostensibly providing solid attachment for mussels. We measured dissolved oxygen, temperature, and conductivity at each site during sampling, using a YSI-85 multimeter. We immediately froze surface grab samples for later analyses of pH, soluble reactive phosphorus, nitrate, and calcium hardness using a Hach DREL 2010. All observations are consistent with acceptable Zebra

Mussel habitat (parameter lows, means, highs): 17.5, 18.8, 21.6 °C; 7.9, 9.8, 11.9 mg/L D.O.; 394, 489, 519 µS conductivity; 0.1, 2.1, 3.3 mg/L NO<sub>3</sub>; 0.0, 0.14, 0.47 mg/L PO<sub>4</sub>; 7.1, 7.9, 8.8 pH. We suggest that the Lake does provide suitable habitats, and the absence of the species indicates the success of efforts to halt its spread, or unknown factors rendering the habitat unsuitable.

### 28. STATUS OF THREATENED ARVICOLINE RODENTS IN NORTHEAST IOWA: CORRELATIONS BETWEEN HABITAT QUALITY AND AVAILABILITY

R. Shellabarger and D. A. McCullough

*Wartburg College*

Arvicoline rodents play a key role in vegetation regulation in Iowa's wooded grasslands and prairies. Three of these rodents with remaining potential habitats in Iowa are the meadow vole (*Microtus pennsylvanicus*), prairie vole (*Microtus ochrogaster*), and southern bog lemming (*Synaptomys cooperi*). As a result of increased habitat fragmentation across the state, suitable arvicoline habitat has diminished, and in response, the abundance and diversity of arvicolines has decreased. This study combines trapping data from nine sites in Northeast Iowa to present a current picture of arvicoline rodent distribution. Data suggests that meadow voles now occupy areas once inhabited by southern bog lemmings and prairie voles, while the two displaced species appear to be rare or absent from those sites. These results suggest a need for contiguous green-space corridors between habitat patches and/or expansion of existing fragments, in order to create habitats that are conducive to larger and more diverse arvicoline populations.

### 29. MONITORING THE IMPACT OF EUROPEAN BUCKTHORN IN TWO FOREST COMMUNITIES IN NORTHWESTERN IOWA

T. T. Tracy, D. Dockter, J. Boersma, E. Vander Broek, R. Weeks and A. Kolb

*Northwestern College*

The key objective of this study is to elucidate the short- and long-term impacts of the invasive European buckthorn (*Rhamnus cathartica*) and its removal on the flora and fauna of two forests in Sioux County, Iowa. In 2005, we established 30 research plots in a five-acre floodplain forest near Alton, Iowa, and in 2006, we established 10 plots within a 75-acre upland forest near Hawarden, Iowa. At both sites we initially surveyed each plot for buckthorn density, overstory composition, and vegetative cover and composition, and we collected soil samples from each plot for analysis of nitrogen content. We then paired plots according to similarity of buckthorn density and overstory composition. We removed all buckthorn from treatment plots and treated stumps with herbicide. In 2006, we re-surveyed all plots in Northwestern's forest and also surveyed invertebrates every 5-6 weeks from April through October using pitfall traps. We intend to survey all plots in both forests annually for the foresee-

able future to observe a) whether differences exist/emerge between the control and treatment plots, and b) whether buckthorn density relates to soil properties and floral and faunal diversity within the control plots.

### **30. THE EFFECTS OF A SPRING BURN ON NOXIOUS WEEDS IN A TALLGRASS PRAIRIE**

E. Vander Broek, J. Boersma, R. Weeks and T. T. Tracy  
*Northwestern College*

In an effort to control Canada thistle (*Cirsium arvense*), a spring burn was conducted in April 2006 Northwestern College's 20-acre tallgrass prairie near Hawarden, Iowa. To examine the efficacy of the burn in controlling the thistle and other noxious weeds, we performed a vegetative survey of the prairie in September 2006 and compared post-burn plant composition to survey results from the same survey location in the years preceding the burn. Our findings suggest that the spring burn actually increased the proportions of weeds while decreasing proportions of several native species. We conclude that the spring burn was counterproductive in controlling weed growth in our prairie and that further intercession with a better-timed burn, plus spraying and cutting, is warranted.

## **Ecology & Conservation Section**

### **ORAL PRESENTATIONS**

#### **31. REPRODUCTIVE CHARACTERISTICS OF THE ORNATE BOX TURTLE, *TERRAPENE ORNATA ORNATA*, IN EASTERN IOWA**

J. Whitman<sup>1</sup>, R. Black<sup>2</sup>, A. McCollum<sup>2</sup> and N. Bernstein<sup>1</sup>  
*Mount Mercy College<sup>1</sup>, Cornell College<sup>2</sup>*

Box turtles, *Terrapene ornata ornata*, are terrestrial turtles located in sandy prairies that dig nests and lay eggs during summer months. Radio-telemetry was used to monitor box turtles from May-June 2006 in eastern Iowa. Box turtles were monitored nocturnally and diurnally, and non-predated box turtle nests were excavated at the end of the study (n=14) and clutch data were recorded. The mean number of eggs per clutch was 4.71. An inverse relationship existed between clutch size and egg volume ( $r^2=-0.5354$ ). There was no relationship between turtle size and egg size ( $r^2=-0.0111$ ) nor turtle size and clutch size ( $r^2=0.0526$ ). High levels of vegetative resources and a low sample size of identified nesting turtles (n=5) may be possible explanations for relationships observed.

**Visit the Iowa Academy of Science on the web:**  
<http://www.iacad.org>

### **32. CEDAR RIVER MUSSEL RESTORATION PROJECT**

T. Brady<sup>1</sup> and L. Anderson<sup>2</sup>

*United States Fish and Wildlife Service<sup>1</sup>, Hartman Reserve Nature Center<sup>2</sup>*

Mussels are great indicators of water quality! Their livelihood depends on how clear and clean their aquatic habitat is. Through the Cedar River Mussel Restoration Project, Hartman Reserve Nature Center hopes to create awareness about the importance of water quality here in Iowa. Hartman Reserve Nature Center has been assisting biologists with the reintroduction of native freshwater mussel species in the Cedar River. Working with the U.S. Fish & Wildlife Service and the Iowa Department of Natural Resources, project staff have introduced fish inoculated with Plain Pocketbook and Black Sandshell glochidia (larval mussels) to the Cedar River and lakes in the Waterloo/Cedar Falls area. In addition to inoculating fish, staff and volunteers have gone "pollywogging" to search for suitable habitat, placed mussel cages in the lake, released fish, removed mussels from the cages, released juvenile mussels, and helped to clean the cages for the next phase. During this project, a thousand fish have been inoculated and released and 3,600 juvenile mussels have been placed in the river for observation during the next several years. Biologists will be monitoring these mussels to answer questions about low densities of mussels on the Cedar River.

### **33. FOREST FLOOR MACROINVERTEBRATES AND EUROPEAN BUCKTHORN: IMPLICATIONS FOR INVASIVE SPECIES MANAGEMENT**

L. Furlong

*Northwestern College*

This study is part of a larger project exploring the effects of an invasive introduced species, European buckthorn (*Rhamnus cathartica*), and its removal on a floodplain forest in northwestern Iowa. The literature indicates that forest floor communities are sensitive to habitat structure, management, and disturbances. To explore the responses of forest floor macroinvertebrates to our manipulation, we set out 4 pitfall traps in each of 30 sample plots (15 control=buckthorn remains, 15 treatment=buckthorn removed) for 24-hour "trap periods" throughout the spring, summer, and fall of 2006. Initial analyses indicate that variation in macroinvertebrate richness and abundance has a strong seasonal component. Invertebrate richness and abundance varied with treatment and buckthorn densities; however, the significance of these responses differed depending upon season. With respect to forest floor communities, implications for invasive species management include the importance of multiple sample periods and careful consideration of potential treatment impacts.

#### **34. DEVELOPMENT OF AN INVERTEBRATE-BASED TERRESTRIAL INDEX OF BIOTIC INTEGRITY OF IOWA TALL-GRASS PRAIRIE<sup>BBP</sup>**

J. Orlofske and D. Debinski  
*Iowa State University*

Invertebrate surveys have become a useful tool for scientists and natural resources professionals concerned with aquatic ecosystem quality. These invertebrate assessments or indices of biotic integrity can provide information that would be difficult or more expensive to gather by alternative means. However, tools like these have not been developed for Iowa's critical and vanishing prairies. By combining several broad sampling methods: sweep netting, pitfall and Berlese funnel traps in a standardized protocol along a gradient of quality, or biotic integrity, we can develop a terrestrial index of biotic integrity. The surveys will describe the how the invertebrate communities differ at remnant, restored and recreated prairies and how we can relate invertebrates collected from these methods to a meaningful category of quality. This initial project is intended to provide Iowa scientists and professionals with a new and useful tool, as well as more fundamental knowledge of prairie invertebrate ecology. Preliminary, sweep net survey results indicate that insect communities can be used to differentiate the prairie types.

#### **35. THE EFFECTS OF VARYING SEEDING RATES OF *BOUTELOUA CURTIPENDULA* AND MOWING ON NATIVE PLANT ESTABLISHMENT IN A NEW PRAIRIE RECONSTRUCTION**

R. L. Welch, D. Smith and D. Williams  
*University of Northern Iowa*

A major problem in prairie reconstruction is weed competition. Research has shown that mowing in the first year can increase emergence and survival of prairie plants. The use of nurse crops (companion crops) has been suggested as an alternative to mowing for weed suppression. The goal of this study is to examine varying seeding rates of *B. curtipendula*, as a nurse crop in mowed and unmowed plots to see if it can successfully suppress weeds without reducing the establishment of seeded natives. We hypothesize that increasing the seeding rate of *B. curtipendula* will reduce weed growth and promote an increase in native seedling numbers. In addition we hypothesize that number of the native seedlings in mowed plots with no *B. curtipendula* seed will be similar to unmowed plots seeded with *B. curtipendula*. Seeds from 25 different species of grasses and forbs were broadcast on June 18th at Neal Smith Wildlife Refuge at a seeding rate of 22 seeds/m<sup>2</sup>. *B. curtipendula* was also broadcast at seeding rates of 0, 22, 43, 173, and 345 seeds/m<sup>2</sup>. The site was mowed mid-August of the first growing season and approximately every three weeks of the second growing season. Sampling was done early September 2005, in June and early September 2006. Native seedling counts, biomass clippings, basal cover, and photosynthetic light were measured. Results show no significant

difference ( $p > 0.05$ ) between seeding rates in total native species composition.

#### **36. TESTING METHODS TO REDUCE RODENT GRANIVORY IN A PRAIRIE RECONSTRUCTION**

C. Hemsath and L. L. Jackson  
*University of Northern Iowa*

Many prairie reconstructions have much lower forb densities compared to remnants. One possible explanation may be from the ubiquitous populations of granivorous small mammals. Previous studies have indicated rodents can be responsible for the removal of up to 70-90% of seeds in a grassland. In this study we tested the effectiveness of the chemical capsaicin and an alternative food source of sunflower seed to reduce the amount of granivory on broadcast forb seeds. The study consisted of using seeds of *Silphium integrifolium* glued onto 14cm x 11cm pieces of sandpaper. The seeds received one of two treatments, control or coated in capsaicin. Fourteen cards, seven control and seven capsaicin treated, were placed into 16, 5m x 5m plots in a 30-year-old tallgrass reconstruction. Half of the plots then received an alternative food treatment of sterilized sunflower seeds. The number of seeds remaining on each card were recorded daily after being placed in the prairie. Results have indicated a significant reduction in seed predation on the seeds with the alternative food source. The capsaicin treatment has not significantly reduced predation. Other companion studies have shown mixed results due to several factors influencing predation such as planting time and species. These methods may show some promise to reduce rodent seed predation and increase the amount of seeds available for germination, increasing the success of a reconstruction.

#### **37. FLUORINE UPTAKE BY CULTIVATED AND UNCULTIVATED GRASSES**

G. A. Skinner, R. J. Leichty and S. H. Emerman  
*Simpson College*

Although fluorine is an essential nutrient for grazing animals, it has no known physiological function in grasses, which suggests an interesting co-evolution between grasses and grazers. The objective of this study was to ask two questions: (1) Do uncultivated grasses buffer their uptake of fluorine in order to keep plant fluorine in the optimum range for grazers? (2) Have cultivated grasses lost the ability to buffer their uptake of fluorine? Fifty plants each of the uncultivated grasses big bluestem (*Andropogon gerardi*), little bluestem (*Schizachyrium scoparium*) and switchgrass (*Panicum virgatum*) and the cultivated grasses wheat (*Triticum aestivum*), rye (*Secale cereale*) and oat (*Avena sativa*) were grown in a greenhouse. Each species was separated into 10 treatments corresponding to irrigation with NaF in concentrations 0-9 ppm F. All plants were harvested eight weeks following the beginning of treatments. The shoots for each treatment and species were combined. The total fluorine concentration of shoots is currently being determined by di-

gestion with 17 M NaOH at 600 °C in a muffle furnace. The concentration of the fluoride ion in the extractant is being measured with a Hach DR/890 Spectrophotometer. The soil pH is being measured for the soil in each pot. Results will be reported at the meeting.

### **38. IOWA'S SYSTEM OF STATE PRESERVES: CHALLENGES TO CONSERVATION OF BIODIVERSITY**

L. L. Jackson<sup>1</sup> and D. Q. Lewis<sup>2</sup>

*University of Northern Iowa<sup>1</sup>, Iowa State University<sup>2</sup>*

Prairie preserves were purchased and set aside in state ownership starting in 1950, following the surveys of prairie remnants by Dr. Ada Hayden. The state preserve system was established by the Iowa State Legislature in 1965 to protect the best examples of our natural and cultural heritage, thus widening the concept of preserves and giving them the highest level of legal protection of any lands in Iowa. Currently there are 93 state preserves comprising around 9,400 acres. Although legally protected, the state's biological preserves face many challenges, including a lack of adequate financial and staff resources, effects of activities by adjacent landowners, succession, exotic species, and global change. Managing sites is often complicated by lack of funding and expertise, conflicting management goals and activities, small size, and landscape context. Protection of Iowa's biological diversity through this preserve system can be improved by a) professional development of Preserve managers; b) cultivation of better relationships with rural neighbors about the significance of the preserves; c) greater public awareness and support.

### **39. MEASURING ENVIRONMENTAL LITERACY: A NEW SURVEY INSTRUMENT FOR THE MIDWEST**

S. R. M. O'Brien, J. L. Pease and F. O. Lorenz

*Iowa State University*

A desired outcome of environmental education (EE) is to create a public that is environmentally literate. Many EE programs and materials have this as a stated purpose. However, measuring environmental literacy (EL) has remained illusive. Some national surveys have been conducted that attempt to measure it. A few states have attempted to periodically survey their citizenry to gather environmental literacy data. While these are important attempts, we believe that many of the questions asked still lack in accurately measuring EL. Further, we believe that these important instruments fail to account for cultural and educational system differences and don't always consider accepted benchmarks for EE. This project developed an instrument that attempts to improve measurements of three environmental literacy elements: awareness of, knowledge about, and attitudes of people toward environmental issues, especially as they relate to the Midwest environmental problems. It included development of careful, statistically valid questions, which were tested with Iowa State University's students across all disciplines. We anticipate that this instrument, when pub-

lished, will help track the results of our EE efforts. If administered annually in a random sample, we believe it will help guide EE curricular efforts and adult EE as well. Over time, it can also be used to track Iowa's environmental literacy levels. Results and analysis of this research will be presented and discussed.

### **40. DEVELOPING A LAND MANAGEMENT PLAN FOR CENTRAL COLLEGE'S CARLSON-KUYPER FIELD STATION<sup>PPP</sup>**

S. Sandberg

*Central College*

Land management is essential to the restoration of prairies and conservation efforts for a preserve area. Invasive species management must be used to ensure native species prosper and are not forced out. The Carlson Kuyper Field Station was donated to Central College in order to help restore a natural prairie. The field station is 60 acres which includes planted prairie and woodland ravines. Management to date has been haphazard, with efforts depending on interests and time available by Central College faculty since the college acquired the land in 2000. Proper management will entail a long term land management plan for the field station which I will be developing, focusing on addressing important issues. These issues include: invasive species, tree line encroachment on native prairie, and gully erosion. I will use GIS and surveying techniques to lay the ground work for future work, while establishing a management plan that can be followed to guide future work in restoring and maintaining the prairie and the field station. In this presentation, I will discuss the process of developing a plan and the management guidelines for this area.

## **Engineering Section**

### **POSTER PRESENTATIONS**

#### **41. MEASUREMENT AND CHARACTERIZATION OF OPTICAL NETWORKING DEVICES**

K. Meyer, S. Kemmet and M. Mina

*Iowa State University*

As optics becomes increasingly integrated into electronic devices and networking systems, there is a growing demand to be able to characterize optical sources and devices. Since there is a great variance between devices in their optical requirements, it is beneficial to be able to identify specific optical characteristics. In this paper, the different methods of determining such characteristics are discussed. First, optical sources, including LEDs and different types of lasers, were characterized by their spectral densities, half power bandwidth (HPBW), and polarization characteristics. Next, the properties of different optical devices were characterized, including single and multi-mode fibers, polarization maintaining fiber, and different 3dB couplers. In addition, insertion loss was determined by employing diverse methods for the different devices.

This paper provides practical discussion for understanding characterization of optical sources and devices, as well as for understanding the measurement of these properties. These characterization properties have become increasingly important in realizing the speed, reliability, and bandwidth optically integrated devices offer.

#### **42. COMPARISON OF BIOREFINERIES BASED ON THE BIOCHEMICAL AND THERMOCHEMICAL PLATFORMS**

M. M. Wright and R. C. Brown  
*Iowa State University*

There are two major pathways to the conversion of biomass to liquid fuel: the biochemical and thermochemical pathways. The biochemical path, also known as the sugars platform, relies on enzymatic hydrolysis and fermentation. Thermochemical conversion employs gasification techniques along with catalytic upgrading. Ethanol from corn grain fermentation is a commonly known process. Fermentation plants are generally small scale, low capital and operating cost facilities. With increasing demand, plant capacities are expected to increase with implications on the production costs. Biochemical plants are not economically suited for large-scale operation when compared to the thermochemical platform. Biomass can be converted to synthetic fuels such as methanol, hydrogen, and Fischer Tropsch liquids through various thermochemical processes. At small scales (less than 100 million gallons per year), thermochemical processes are expensive to build and operate. Due to economies of scale, large-scale thermochemical plant's unit costs are actually lower than biochemical plants of the same energy capacity. The purpose of this paper is to prove that thermochemical plants are less expensive than similar biochemical facilities. An ethanol plant with 150 million gallons of gasoline equivalent capacity and \$3/bu corn grain has a production cost of \$1.74/gallon of gasoline equivalent. A similar methanol plant, at \$50 per Mg biomass, has a production cost of \$1.19 per gallon of gasoline equivalent. This paper compares the costs of thermochemical and biochemical on an equal fuel output basis.

## **Engineering Section**

### **ORAL PRESENTATIONS**

#### **43. GENERATION OF PATIENT SPECIFIC MODELS FOR ORTHOPEDIC SURGICAL PLANNING**

S. Tadepalli, K. H. Shivanna, V. A. Magnotta and N. M. Grosland  
*University of Iowa*

Computational simulations of surgical procedures are of significant interest in orthopedic-related research. Over the years, the finite element method has emerged as a viable means to determine the stresses and strains in implants and their interaction with the host bone. Very few surgical planning studies, however, have been performed

on patient-/subject-specific models. Toward that goal, we have made advancements in automating the patient-specific bony geometry definitions from CT and/or MR image datasets and toward automating finite element model development. The objective of this project is to advance these efforts by interactively incorporating implants into such models. We have developed novel methods for cutting and drilling holes in three-dimensional finite element models of bony structures. These models may then accommodate the implant under consideration. One day, such models may aid the surgeon in preoperative planning, ultimately resulting in an improved clinical outcome. In this talk we present a detailed process of creating patient-specific models and some preliminary results of the same.

#### **44. AUTOMATED HEXAHEDRAL MESHING OF ANATOMICAL STRUCTURES USING DEFORMABLE REGISTRATION**

R. R. Bafna, V. Magnotta and N. Grosland  
*University of Iowa*

This work introduces a novel method of automating the process of generating patient-specific finite element (FE) models using a mapped mesh technique. The objective is to map a predefined mesh of high quality (template) directly onto a new (subject-specific) bony surface definition, thereby yielding a similar mesh with minimal user interaction. This process begins by applying an iterative closest point registration to define an affine transformation to bring the template mesh into rough correspondence with the subject-specific surface; accounting for size, position, and orientation differences between the representations. To bring the template mesh into correspondence with the subject surface, a deformable registration technique based on the finite element method is then applied. Forces used to drive the registration are based on the distances between the surface of the template solid mesh and the subject-specific surface. These forces are applied in the direction of the template normals. The procedure has been made hierarchical allowing several levels of mesh refinement to be used for the registration procedure, thus reducing the time required to achieve a solution. Our initial efforts have focused on the bones of the hand. Mesh quality metrics, such as element volume, Jacobian and edge length were evaluated. Furthermore, the distance between the subject surface and the mapped template were measured.

Be a science leader. Join an IAS Standing Committee or serve as a Section Chair.

#### **45. INTEGRATION OF MOTION CONTROL SYSTEM WITH NON-INVASIVE THERAPEUTIC ULTRASOUND**

M. M. Heise<sup>1</sup>, T. Long<sup>1</sup>, V. Amin<sup>1</sup>, S. McClure<sup>2</sup> and L. Wu<sup>3</sup>  
*Iowa State University, Center for Nondestructive Evaluation<sup>1</sup>, Iowa State University, Department of Veterinary Clinical Sciences<sup>2</sup>, Iowa State University, Virtual Reality Application Center<sup>3</sup>*

Motion control systems have been used for precise control of devices in medical research, such as High Intensity Focused Ultrasound (HIFU). HIFU has been developed as an alternative, non-invasive tumor (e.g. prostate tumor) treatment method by creating deeply embedded thermal damages at a focal area without damaging the surrounding and overlaying tissues. In our experiments, a HIFU transducer is aligned coaxially with an ultrasonic imaging probe which allows real-time visualization of the target tissue before, during and after HIFU experiments. The transducers require precise mechanical positioning to perform various tasks, such as constructing 3D volumes from parallel, evenly spaced ultrasonic scans, burning lesions at specific locations and monitoring HIFU progress. Furthermore, the whole system has to be portable to allow tests to be done in live animal applications, e.g. College of Veterinary Medicine at Iowa State University. To address these needs, a mechanical control system is assembled to perform these tasks. The system consists of three stepper motors (arranged in XYZ directions), from Parker Automation, with movement in increments of 200 microns. These stepper motors are controlled by a controller interface and software from National Instruments. In addition to this frame, a custom robotic arm attachment is being designed to secure the ultrasound transducers for imaging and therapy. This arm provides two additional degrees of rotation which are used for fine adjustment of the HIFU focus within the target area. With stepper motors and the robotic arm, the researcher can locate, position, and monitor a target region for HIFU treatments. The robotic arm displays a promising means to portable and controlled experimentation.

#### **46. NOVEL COMPOSITE MATERIALS FOR MICROWAVE ABSORPTION**

N. L. Fischer and N. Bowler  
*Iowa State University*

The ability to absorb electromagnetic radiation in the microwave frequency range is an area of research that has received increased attention recently. Many telecommunication and heating devices operate in this frequency range, making the development of materials responsive to microwave radiation particularly pertinent. Traditionally, iron filler particles dispersed in a matrix have been used for absorption, caused by the ferromagnetic resonance properties of iron. As the high mass density of iron can severely limit the usefulness of this technology, new materials for absorbing microwave range electromagnetic radiation should be developed. Previous studies have

shown that a composite material composed of hollow glass spheres with a radius of approximately 30 microns coated with a thin layer of Tungsten dispersed in a paraffin wax matrix exhibit absorption properties in the 1-100 GHz frequency range. This absorption, however, is due to dielectric relaxation effects, instead of ferromagnetic resonance as in the case of iron particles. This study compares the dielectric properties of three different composites formed with metal-coated hollow glass filler particles. These vary in mean radius from 15 to 60 microns with the tungsten thickness ranging from 2 to 20 nm. In each case a 3 nm outer coating of alumina prevents conduction between touching particles. These particles were placed in a matrix of paraffin wax at volume fractions of 0.0 - 0.6 in 0.1 increments and samples were die-pressed in order to measure dielectric constant in the frequency range 0.5 to 18 GHz using a transmission-line technique.

#### **47. EFFECT OF CROSSLINKING ON THE FRICTION AND WEAR BEHAVIOR OF SOYBEAN AND TUNG OIL-BASED POLYMERIC MATERIALS**

S. K. Bhuyan, L. S. Holden, S. Sundararajan and D. Andjelkovic  
*Iowa State University*

Biopolymers produced from renewable and inexpensive natural resources, such as natural oils, have drawn considerable attention over the past decade. In this study, the friction and wear behavior of biopolymers prepared from low saturated soy-bean oil and tung oil by catalytic-copolymerization with divinylbenzene and styrene are evaluated as a function of cross-linker density. The samples ranged from elastomeric (low cross-linking density) to brittle (high cross-linking density). Tribological measurements were performed using a ball-on-flat reciprocating microtribometer. Adhesive friction and wear behavior was evaluated using a 1.2 mm radius silicon nitride spherical probe. Abrasive friction and wear experiments were conducted using a 100 micron radius conical diamond probe with a 90° cone angle. Wear volumes were estimated from groove profiles obtained from profilometry and atomic force microscopy (AFM). AFM and scanning electron microscopy of wear tracks were used to elucidate deformation mechanisms in the various samples.

Share local events, recognitions,  
discoveries with your fellow  
IAS members.

Send your science news  
to the IAS Office for publication  
in the Bulletin.



#### **48. PRESSURE EFFECTS ON A SINGLE DROPLET IMPACTING ONTO A FLAT SMOOTH SURFACE**

I. Karakaya, A. Dix and A. Ratner  
*University of Iowa*

Drop impact on a flat dry surface has been under investigation since the late 1880's. In this study, a pressure chamber was designed and constructed for investigating the effect of the surrounding gas pressure on the liquid drop process. The pressure chamber is steel with large quartz imaging windows. A liquid reservoir is attached above the chamber and connected by high strength clear plastic tubing. A high speed camera is used to capture the droplet impact. Three drop heights, 24cm, 37cm, and 50cm were tested and the pressure was varied between 0 bars to 20 bars. Water and Methanol were tested under these conditions and decreasing maximum spread diameter was observed in response to increasing chamber pressure.

#### **49. CFD RESEARCH OF BIOMASS COMBUSTION**

X. Zhang and A. Ratner  
*University of Iowa*

The University of Iowa is using oat hull as a substitute fuel in its grater stoker boiler Unit 10. The work undertaken here is to simulate the combustion process in the stoker boiler under different operating conditions by using CFD methods and, in order to achieve an optimized combustion configuration. The Fluent CFD code is employed with a non-premixed combustion model. The coal fuel and oat hull fuel are injected separately and both are treated as particles based fuels. The air in this simulation is injected from several locations and is taken as one of the parameterized variable. Based on this and several different ratios of oat hulls to coal (with the total heat output held constant) were investigate. In addition, the influence of oat hull injection location was examined. The results show that under the same rate of heat output, using oat hulls can decrease the mass fraction of carbon dioxide in the stoker and produce a quicker combustion due to the hulls much lighter weight and lower moisture content. The relationship between the amount and speed of the air and the oat hulls combustion is also critical.

#### **50. PREDICTION OF SHEAR BAND SPACING IN CHIPS PRODUCED IN METAL CUTTING USING NON-LINEAR DYNAMICS APPROACH**

P. Karra, A. C. Bragg and A. Chandra  
*Iowa State University, Department of Mechanical Engineering*

Shear band spacing controls the nature of chip formation in machining of ductile materials. A non-linear dynamics model for predicting the shear band spacing is developed based on the approach used by Burns and Davies (1997) and Wright (1982). The proposed model incorporates the competition between strain hardening and thermal softening characteristics, and accounts for associated shear

angle oscillations. Thus, the model assigns a variable thickness to the shear zone that is inherent in a machining process. Numerical simulations based on the proposed model are developed to predict the shear band spacing considering one machining-heating-cooling cycle. The simulations are carried out for different materials ranging from 99.99% pure Cu, Al 6061, AISI 1045, AISI 4140 and Ti-6Al-4V. Experiments are conducted on each of the materials and the shear band spacing are measured. Comparisons with experimental results indicate that the proposed model predicts the overall magnitude of shear band spacing quite accurately at lower speeds. With increasing cutting speed, the model (utilizing material parameters from low strain rate tests) typically underestimate the increase in shear band spacing. Probable reasons for these discrepancies are discussed, and possible remedies will be suggested.

## **Environmental Science & Health Section**

### **POSTER PRESENTATIONS**

#### **51. APPLICATION OF NITROGEN ISOTOPE TECHNIQUES TO IDENTIFY NITRATE SOURCES IN THE CEDAR RIVER WATERSHED, IOWA**

S. Gautam and M. Z. Iqbal  
*University of Northern Iowa, Department of Earth Science*

Stable isotopes of nitrogen were used to identify sources of nitrate contamination to ground water and surface water in the Cedar River Watershed, Iowa. Ground water samples from 20 private wells and surface water samples from 10 sites in the Cedar River and its tributaries were collected. A total of 90 samples were collected in between crop growing season from May 2006 to September 2006. Samples were analyzed for  $\delta^{15}\text{N}$  values using Thermo Delta plus isotope ratio mass spectrometer in Cornell Isotope Lab, NY. The concentrations of nitrate in the water samples were determined with a Dionex® (Model DX-120) ion chromatograph with suppressed conductivity. 19 out of 20 wells were detected with nitrate contamination from agricultural leachate. In 35% of the wells, nitrate concentration exceeded the U.S. EPA's recommended maximum contaminant level (MCL) of 45 mg/l (as  $\text{NO}_3^-$ ) for drinking purposes. 8 out of 10 samples exceeded MCL for nitrate in surface water in the first sampling but none exceeded in the second and third. The  $\delta^{15}\text{N}$  values of +0.450‰ to +5.150‰ were detected in ground water suggesting commercial fertilizers with values of 0 ‰ to +3.5‰ being the most typical for this source. Similarly, the  $\delta^{15}\text{N}$  values of +1.481‰ to +5.164‰ were found in surface water suggesting commercial fertilizers as the source with the possible contribution from organic nitrate as well. Animal wastes (including humans) were not found as the source of nitrate contamination. Thus commercial fertilizers and soil organic nitrate are the sources of contamination in the study area.

## **52. SURVEY OF FISH FEMINIZATION IN THE MISSISSIPPI RIVER: ESTROGEN EFFECTS ON SEX RATIOS AND VITELLOGENIN LEVELS OF WHITE BASS (*MORONE CHRYSOPS*)<sup>BBP</sup>**

S. Knight, A. B. Wisniewski and C. Hruby  
*Drake University*

Significant attention has been given to the understanding of environmental effects on hormone activity. Chemicals that mimic, alter or block the action of endogenous hormones are termed endocrine disruptors. Endocrine disrupting chemicals (EDC's) became a topic of research and media discussion in the early 1990's. By 1996 the Environmental Protection Agency had organized programs to investigate the presence and effects of endocrine disrupting substances on human and wildlife populations. Potent chemicals such as DDT, PCB's and atrazine have limited use due to their adverse effects on physiologic systems. Observations of endocrine disruption in fish populations first occurred in Europe (Flammarion et al 2000; Jobling et al 1998) but the phenomena of abnormal development in fish exposed to endocrine disrupting compounds has spread and has recently been discovered in the U.S, Canada and Japan (Bringolf and Summerfelt 2002; Folmar et al 2001; Goodbred et al 1996). Exposure to estrogen and EDC's alter the reproductive system in several species of fish and induce production of vitellogenin. Vitellogenin is an egg protein precursor produced by female fish and is commonly used as a biomarker for estrogen exposure when produced by males (Bjerregaard LB et al 2006; Bringolf and Summerfelt 2002). Major contributors of estrogen and EDC's in the watershed include: municipal waste plants, industrial plants, agricultural run-off, and household sewers. We hypothesize that demasculinization/feminization of males due to exposure to EDC's found in the Mississippi River as indicated by vitellogenin production will increase with exposure to higher concentrations of estrogen in male white bass.

## **53. SOYBEAN INDUCED LIGAND EFFECTS ON THE VARIOUS METAL SOLUBILITY**

A. McDonnell, P. Schwartz and C. Kim  
*University of Dubuque*

The effects of soybean induced ligands on the dissolution of various trace metals (iron, copper, and lead) have been studied. Raw soybeans were air dried followed by ground and sieved (sieve number 30 - 0.6 mm). The ground soybean was mixed with water using a shaker in a mass (g) to volume (ml) ratio of 1 to 10 for 10 - 12 hours. The solution was filtered before reacted with metals. Kjeldahl nitrogen determination method has been adopted to evaluate the quantity of available nitrogen-related Lewis base (ligand) sites for metal complexation. According to our observation, higher pH produced more Kjeldahl nitrogen. In addition, copper and iron solubility increased significantly at higher pH values (9 - 12) than neutral pH ranges (6 - 8). Soybean induced ligands might be complexed with aqueous phase metals increasing the

solubility and the ligand sites are more active on high pH values attracting metal to form complexes.

## **54. SEASONAL VARIATION OF ATRAZINE AND METOLACHLOR CONCENTRATION IN TWO PELLA, IOWA WATERSHEDS<sup>BBP</sup>**

R. A. Mino, L. E. Kelderhouse, E. Twining Gerdes and S. Brice  
*Central College*

Growing concern about the effects of pesticides require a better understanding of the spatial and temporal application and distribution of these chemicals in our environment. Research at Central College has been focusing on atrazine and metolachlor, two herbicides commonly used in Iowa. Since these herbicides are applied mostly in the spring, concentration levels vary seasonally and often measurements in local waters are taken months after application, which does not provide us with a complete picture of true concentrations in the water. Around 1-2% of the atrazine that is applied annually moves into water via runoff or through groundwater infiltration. Concentrations can vary due to differences in pesticide use, application practices and timing, soil composition and amount of rainfall. Atrazine has a relatively long half life of 36-37 days in water which can increase further to 60-100 days or more under certain conditions. Metolachlor also is also highly persistent in water with a half life of 34 days. Our study compares atrazine and metolachlor levels found pre, during and post herbicide application in two local Pella watersheds, Thunder Creek and an unnamed one, in 2007. At the same time, we are gathering data from local farmers within the watershed, to develop a spatial perspective on the application of these chemicals and gage the amount that does enter our waters. Sampling around the time of application provides a better measure of the concentration of these two herbicides. A better measure is necessary for properly monitoring possible effects of these chemicals.

## **55. THE COMBINED EFFECTS OF ATRAZINE AND METOLACHLOR ON THE PRODUCTION OF HARMALA ALKALOIDS IN PASSION FLOWERS<sup>BBP</sup>**

K. Schledewitz and C. Haustein  
*Central College*

Pesticides have played an important role in the Midwest's agricultural productivity for the last half decade. While pesticides increase crop yield, they may also have negative effects on the environment and its inhabitants. Atrazine and metolachlor are two of the most commonly used herbicides not only in Iowa, but also throughout the United States. The effects these herbicides in combination have on the metabolism of established, non-target plants have not been studied. A change in the metabolism of these established plants would indicate an influence by the combination of herbicides on non-target plants. *Passiflora incarnata* produce harmala alkaloids that are easily extracted and quantified. Previous studies have associ-

ated these alkaloids with plant growth. *P. incarnata* seeds were sprouted and grown. When a plant height of 12 inches was obtained, the plants were divided into two groups, one control and one experimental. The experimental group was watered with a solution containing both atrazine and metolachlor in combination. After four weeks of treatment, the stems and the leaves of the plants were harvested and dried. A technique involving ethyl acetate was used to extract the harmala alkaloids, which were then quantified with HPLC. Preliminary studies have shown no difference in alkaloid content between the two groups.

#### **56. EVALUATION OF MANURE AS NUTRITIONAL RESOURCES FOR VEGETATION**

S. Timmons, B. Bohnsack and C. Kim  
*University of Dubuque*

Manure a major byproduct of many animal farms in Iowa has been utilized as a natural fertilizer providing nutrition for vegetation. Efforts have been performed to evaluate the availability of nitrate ( $\text{NO}_3^-$ ), phosphate ( $\text{PO}_4^{3-}$ ) as well as various metal ions such as sodium ( $\text{Na}^+$ ), calcium ( $\text{Ca}^{2+}$ ), iron ( $\text{Fe}^{2+/3+}$ ), and magnesium ( $\text{Mg}^{2+}$ ) using either bench top batch or column test. Three different manures from goat, cow, and chicken were collected from the animal farms and fully air dried the manures in a hood. Similar particle size of the samples was used after sieving with sieve number 30 (0.6 mm). It has been shown that the manure might be great resource for of phosphate and goat manure is valuable fertilizer for long term application. Detailed information will be discussed over the presentation.

## **Environmental Science & Health Section**

### **ORAL PRESENTATIONS**

#### **57. CELL CYCLE ANALYSIS OF ATRAZINE-TREATED HUMAN FIBROBLAST CELLS USING FLOW CYTOMETRY**

A. L. Austin and K. R. Dhanwada  
*University of Northern Iowa*

Atrazine is one of the most commonly used herbicides in the United States. Many studies have shown an association between herbicide exposure to increased levels of DNA damage, reproductive and endocrine problems as well as a higher risk for certain cancers. Previous work from our lab showed a decrease in cell proliferation after low-level atrazine exposure (0.8-100 ppb) in normal human fibroblasts with no increase in apoptosis or necrosis. The objective of the current study was to determine a mechanism for the decrease in cell number. We used flow cytometric analysis to see if atrazine-treated cells progressed through the cell cycle differently than control cells and thus resulting in fewer cells after herbicide ex-

posure. We exposed synchronized and unsynchronized normal human fibroblasts to increasing concentrations of atrazine (0-300 ppb) for 24 and 48 hours. Flow cytometric analysis was performed on control vs. treated cells. Results suggest a G1 block in unsynchronized and synchronized atrazine-treated cells after a 24 and 48 hour exposure. However, the block may be dependent on the concentration of atrazine used. The percentage of apoptotic cells was low, supporting previous growth study results.

#### **58. COMPARISON OF PHOSPHORUS LEVELS IN PRECIPITATION IN ADJACENT RURAL AND URBAN AREAS<sup>PPP</sup>**

E. Bartusek  
*Saint Mary's University of Minnesota*

Phosphorus is a key nutrient for plant and animal growth. However, too much phosphorus in a lake may lead to eutrophication and algal blooms. During June through August, precipitation was collected in the vicinity of Albert Lea, Minnesota to study its phosphorus content. The method of collection involved a plastic bag inside a two-liter pitcher. Two sample locations were established, one on the roof of the courthouse within the city limits of Albert Lea and one in a rural area, identified as the Bartusek house, west of and upwind from Albert Lea. It was hypothesized that phosphorus levels would be higher in the urban area. Samples from ten rain events were collected, frozen, and shipped to be analyzed for total phosphorus (Environmental Protection Agency method 365.3). Phosphorus concentrations in rainwater from the two sites were significantly correlated. In contrast to the initial hypothesis, a paired t-test revealed that phosphorus concentration at the Bartusek house was significantly greater than at the courthouse. It may be the case that phosphorus content in rainwater was determined more by the air masses moving through the region than by local effects. Phosphorus levels may tend to be depleted during the time the rain events moved between the Bartusek house and the courthouse. The courthouse had significantly lower phosphorus levels than the EPA standard of 0.1 mg/L while the Bartusek house was not significantly different from 0.1 mg/L.

#### **59. THE EFFECT OF CADMIUM ON THE MATING BEHAVIOR OF *DROSOPHILA MELANOGASTER***

A. Bixler<sup>1</sup> and F. Schnee<sup>2</sup>  
*Clarke College<sup>1</sup>, Loras College<sup>2</sup>*

Cadmium is a heavy metal implicated in genetic and physiological difficulties ranging from cancer to neurological abnormalities. Our research focuses on the effect of cadmium on the courtship of fruit flies, *Drosophila melanogaster*. The courtship behavior of *Drosophila* is well characterized and highly ritualized in nature, and thus is likely to be a sensitive tool in detecting neurological impairment. We raised flies on Carolina Instant *Drosophila* Medium containing 0, 0.1, or 0.5 mM cadmium chlo-

ride and conducted tests on pairs of flies in which neither fly, the male only, the female only, or both flies had been reared on cadmium medium. We observed the pairs for 30 min and recorded the amount of time the male spent courting and whether copulation ensued. When females were reared on 0.1 mM cadmium, there were significantly higher levels of copulation. On the other hand, males reared on 0.1 mM cadmium spent significantly less time courting females. At 0.5 mM cadmium, we observed no effects on male or female mating behavior. These results indicate *Drosophila* courtship is affected by exposure to cadmium but not necessarily in a linear manner.

## **60. EFFECTS OF THE BRUSH CREEK WETLAND COMPLEX ON NITRATE LEVELS FROM THE MONROE WASTE WATER TREATMENT PLANT**

J. Bowzer, S. Sandberg, A. J. Christian, C. Haustein and P. E. Weihe  
*Central College*

Information concerning concentrations of surface water nitrate levels was compiled from Brush Creek wetland complex near Monroe, Iowa from October 30-November 13, 2006. Previous literature suggests that wetlands are an effective method of naturally filtering water sources in the environment. Water samples were collected from various points on the wetland complex and the nitrates were determined using the cadmium reduction method with HACH NitraVer and a HACH kit. Nitrate levels dropped from a high of 19-12 ppm nitrate as N at the waste water discharge site to 1 ppm as the water progressed through the wetlands. GIS and the inverse distance weighting (IDW) were used to visually represent how nitrate levels are decreased by the wetlands. The wetlands were an effective natural filtration system that worked in conjunction with a waste treatment plant to reduce nitrate levels.

## **Geology Section**

### **POSTER PRESENTATIONS**

## **62. QUARTZ GRAIN SURFACE TEXTURES AS AN INDICATION OF INFILLING PROCESSES AND DEPOSITIONAL ENVIRONMENTS ASSOCIATED WITH ICE-WEDGE CASTS IN NORTHEAST IOWA**

M. K. Loux and J. C. Walters  
*University of Northern Iowa*

Ice-wedge casts and polygonal patterned ground are common features of the Iowan Surface of Northeast Iowa. Paleoenvironmental studies in Iowa and adjacent states indicate that tundra conditions existed in Northeast Iowa between 21,000 and 16,500 years BP, the coldest part of late Wisconsinan time. Degradation of permafrost and formation of ice-wedge casts must have occurred near the end of this episode of cold climate, which also promoted extreme erosion of the landscape in Northeast Iowa. The sediment-filled wedges in Northeast Iowa oc-

cur in pre-Illinoian till, and the infilling material is mostly sand. However, the details of the infilling of the wedges are unknown. Since quartz grain surface textures can be successfully used as fingerprints to identify sediment transport processes and depositional environments, we examined surface textures of quartz grains from ice-wedge casts using binocular and scanning electron microscopy in an effort to elucidate this infilling history. Features indicative of glacial, fluvial, and eolian transport are evident. In the coarse to medium sand fractions, well-rounded, spherical to nearly spherical quartz grains predominate. SEM images show most of these larger grains to have characteristics of eolian transport, including features such as upturned plates and dish-shaped concavities. Fluvial characteristics such as v-shaped grooves are also abundant. In the fine to very fine sand fractions quartz grains are commonly angular and show conchoidal fracture, a feature that represents glacial transport or possibly in situ cryogenic fracturing. Preliminary results indicate that the predominate surface texture signature of a sand grain depends on its location in a wedge, and this location is variable. That is, in a given wedge, sand grains collected near the bottom of the wedge may show predominately eolian signatures, whereas grains at other locations in the wedge may show mostly glacial or fluvial signatures. Other combinations may exist in other wedges. It appears that the infilling of the wedges was localized and determined by materials available and processes operating in the vicinity of the wedge during the melting and infilling.

## **63. MORPHOMETRY AND RATES OF MORPHOLOGIC EVOLUTION WITHIN THE PENNSYLVANIAN FUSULINID BEEDEINA (ARDMORE BASIN, OKLAHOMA)**

S. Reisdorph and J. R. Groves  
*University of Northern Iowa*

Fusulinids are important guide fossils because of their supposedly high rates of evolution and abundance in marine sedimentary rocks. In 1966 Dwight Waddell described and illustrated fusulinid foraminifera from Middle and Upper Pennsylvanian rocks of the Ardmore Basin in Oklahoma. Waddell separated these specimens into 12 species in the genus *Fusulina* (now *Beedeina*). We verified Waddell's taxonomic assignments using Canonical Variate Analysis (CVA) and Multivariate Analysis of Variance (MANOVA) on 29 measurements from each specimen. We then determined probable ancestor-descendant relationships by evaluating the morphometric data within

Did you know that your donation to IAS is tax deductible? You can direct your donation to the Junior Academy, Journal, Iowa Science Foundation, Benchmark Fund, or the General Fund. See the Bulletin for more information.

the context of the specimens' stratigraphic position. Once these relationships were established we determined rates of morphologic evolution in four taxonomically important characters: wall thickness in the first volution; radius vector in the first volution; half length in the sixth volution; and maximum diameter of the proloculus. Results show that morphologic evolution was generally slow, on the order of 0.075 darwins, with one darwin being a proportional change of 1/1000 per 1000 years. An exception to the general observation is the relatively rapid change from *Beedeina whitakeri* to *Beedeina acme*, characterized by rates of 0.186 to 0.793 darwins.

## Geology Section

### ORAL PRESENTATIONS

#### **64. AGRICULTURAL CHEMICAL TRANSPORT STUDY, SOUTH FORK IOWA RIVER: OVERVIEW OF GROUND WATER AND HYPORHEIC ZONE INVESTIGATIONS**

E. Smith

*United States Geological Survey*

The USGS (U.S. Geological Survey) is initiating a two-year hydrologic process study to determine the transport and fate of selected nutrients and pesticides within a focused ground water-surface water interaction site as part of the USGS ACT (Agricultural Chemicals Transport) program. The ACT program project objective is to quantify transport of natural and agricultural chemicals through an alluvial aquifer to the South Fork Iowa River. The study area includes a gently sloping 15-acre agricultural field (corn/soybean rotation) separated from the river by about 200 feet of grassy and wooded riparian buffer. Water chemistry and level data will be collected at 22 upland wells and 10 ground water/surface water interaction wells. Ugradient wells will be monitored for changes in water-levels, temperature variations, and well water chemical composition. Data also will be collected from paired vadose zone lysimeters and soil moisture probes installed at the edges of the field and riparian buffer. During 2007 and 2008, wide-scale chemical assessments of well water will be completed several times during the growing season. Initial data collection efforts include well and lysimeter installation, temporal and spatial water-level monitoring, soil core sampling, and an initial site-wide well water chemical assessment. Continuous water-level measurements collected to date indicate strong hydraulic connectivity throughout the alluvial aquifer and a limited hydraulic connectivity between the stream and the adjacent aquifer within the riparian zone. Initial chemical data suggests strongly iron-reducing conditions across most of the site, based upon 10,000 micrograms/L iron concentrations and less than 10 mg/L nitrate concentrations.

#### **65. THE ENVIRONMENTAL IMPLICATIONS OF AGGRADATION IN MAJOR BRAIDED RIVERS AT MOUNT RAINIER NATIONAL PARK, WASHINGTON**

S. R. Beason

*University of Northern Iowa*

The purpose of this study is to quantify the historic rate of river bed filling, and to the extent possible, start to evaluate the factors that control sedimentation in river channels at Mount Rainier National Park. Mount Rainier is the tallest and most glaciated of the Cascade Volcanoes, located in southwestern Washington State. Steep, braided river channels radiate outwards from the volcano in all directions and transport material varying from fine sediment to cobbles and large boulders. As the gradient in the channels decreases downstream sediment is no longer entrained and accumulates in the river bed. Over time, the river bed surface increases in height, or aggrades. River aggradation was previously estimated by early workers at 0.5 to 1 ft (15 to 30 cm) per decade, but until now, there has been no measured, long term data on river filling. Geologists at Mount Rainier surveyed cross sections in the summers of 1997 and 2005. We conducted additional surveying in 2006 to quantify the current rates of aggradation in the Nisqually and White Rivers, two major river channels that have the greatest ability to affect primary infrastructure in the park. These rates were also compared with data derived from historical topographic maps as well as a long profile of the Nisqually and White Rivers, measured in 1910. Aggradation rates quantified in this study depend on gradient and are approximately 6 to 14 in (15 to 36 cm) per decade on the Nisqually River. This rate appears to be increasing based on long profile and topographic map analysis. In areas that experienced debris flows, the aggradation rate averaged 5.7 ft (1.74 m) in a single event with some locations seeing increases greater than 14 ft (4.3 m). In November 2006, Mount Rainier was ravaged by a severe storm that dropped almost 18 in of rain in 36 hours. Surveying found few, if any, places that saw degradation in the river channel from this event, a somewhat unexpected finding. In fact, in areas that saw no debris flows, aggradation was measured ranging between 0.4 ft (12 cm) and greater than 5 ft (1.5 m). Tahoma Creek, near the main Park road, filled in and now the river channel is less than 5 ft (1.5 m) from the bottom of the bridge. Aggradation is a serious management and safety concern for Mount Rainier National Park, as a great deal of Park infrastructure is located in valley bottoms near — or in — major river channels. Through aggradation, river flooding, debris flows and glacial outburst floods can cause overtopping of natural stream banks and levees built along the river which impact roads and buildings as well as Park visitors. These concerns are compounded with the prospect of increased sediment production due to glacial retreat associated with global warming.

Be sure to stop by the IAS Bookstore for books on Iowa and regional topics.

## **66. ACCELERATED RATES OF FORAMINIFERAL ORIGINATION AND EXTINCTION DURING THE LATE PALEOZOIC ICE AGE**

J. R. Groves

*University of Northern Iowa*

Foraminifers experienced increased taxonomic diversity, increased rates of origination and extinction, and shorter mean lineage durations during the Late Paleozoic ice age (LPIA) than during the immediately pre- and post-glacial intervals, a pattern opposite to that exhibited by brachiopods and other marine invertebrates. Much, but not all, of the increase in evolutionary rates can be attributed to the origin and rapid diversification of the fusulinoideans, a narrowly specialized group that may have been prone to high rates of extinction and speciation under the variable, cyclothemic conditions of the LPIA. Increased rates of evolution among non-fusulinoidean foraminifers during the LPIA also may be related in some way to glacioeustatically induced variability of neritic environments.

## **67. LABORATORY ABRASION OF CRINOIDS: IMPLICATIONS FOR ORIGIN OF THE CHARITON CONGLOMERATE**

L. R. Hawkins, M. R. Bennett, R. J. Ellenwood and S. H. Emerman

*Simpson College*

The Chariton Conglomerate Member of the Pleasanton Formation is a limestone quartz-pebble conglomerate exposed in a small number of outcrops in southern Iowa. The Chariton Conglomerate contains many crinoids with rounded edges indicating fluvial transport. In previous work 75 crinoids were extracted from five outcrops extending over 60 km. The percentage roundness was measured as  $(D-d)/D$ , where  $D$  is the crinoid diameter and  $d$  is the diameter of the flat region on the top or bottom of the crinoid. The average values for each outcrop were remarkably consistent, ranging from 28% (S.D. = 11%) to 34% (S.D. = 20%) with no systematic variation in the direction of transport. The objective of this study was to carry out laboratory abrasion of crinoids in order to determine whether crinoids achieve a terminal roundness, which would account for the lack of variation in the downstream direction. Mixtures containing 90% water and 10% sediment were placed into 18 rotary tumblers and tumbled for periods of 6-14 days, corresponding to distances of transport of 130-302 km. The sediment was representative of the Chariton Conglomerate (80% limestone clasts, 10% quartz clasts, 10% crinoids) and included 127 unweathered crinoids among the 18 tumblers. The initial roundness of 32 unweathered crinoids was 15% (S.D. = 10%). The roundness of crinoids for each treatment ranged from 29% (S.D. = 7%) to 42% (S.D. = 15%) with no dependence on time of tumbling. Further treatments will include tumbling crinoids for periods of 1 day-4 months.

## **68. THE NEW IOWA CITY-CLINTON FAULT ZONE AND THE AMANA FAULT ZONE: MAJOR FAULT SYSTEMS IN EASTERN IOWA DELINEATED BY NEW MAPPING**

R. R. Anderson and B. J. Witzke

*Iowa Geological Survey*

New bedrock mapping in eastern Iowa has clarified the western extension of the Plum River Fault Zone (PRFZ) and its relationship to the Amana Fault Zone (AFZ), and has identified a new sub-parallel fault, the Iowa City-Clinton Fault Zone (ICCFZ). The PRFZ is shown to join the AFZ, which trends to central Cedar Co. The down-to-south displacement of the AFZ displays a scissor fault relationship with the down-to-north PRFZ, the zero point in SW Linn Co. The ICCFZ parallels the PRFZ, about 15 miles to the south, and extends from south-central Johnson Co. to east-central Clinton Co. The ICCFZ shows net down-to-south vertical displacements of 110-190 ft in the west and 90-130 ft in the east, similar to displacements seen along the PRFZ (150-300 ft). The AFZ shows maximum net vertical displacements of 230-300 ft in NW Johnson Co. and NE Iowa Co., but displacements decrease near its western terminus. The ICCFZ is well exposed in an old Silurian quarry north of Clinton, which displays a series of high-angle faults with a total of 110-120 ft of stratigraphic displacement along about 1000 feet of exposure. There are clear geomorphic expressions of the ICCFZ in the Mississippi River valley north of Clinton and the Iowa River valley south of Iowa City. The ICCFZ and PRFZ bound an unnamed horst 12 to 15 miles wide and over 80 miles in length in Iowa.

## **Iowa Science Teaching Section**

### **ORAL PRESENTATIONS**

## **69. EFFECT OF A TEACHER EDUCATION PROGRAM ON PRESERVICE SCIENCE TEACHERS BELIEFS ABOUT TEACHING OF SCIENCE AS INQUIRY**

H. Akcay and Z. Yakar

*University of Iowa*

The purpose of this study was to examine how inquiry based learning experiences affect preservice science teachers' beliefs about the teaching of science as inquiry. Thirty preservice science teachers participated in this study during 2006-07 academic year. Teaching Science as Inquiry (TSI) was administered to the preservice science teachers at the end of the semester in which they had a class experiencing science as inquiry. TSI consists of sixty-nine statements which participants answer on a scale that ranges from strongly agree to strongly disagree. The results showed important increases in improvement in beliefs toward science and inquiry based science teaching. Inquiry based learning environment also affect on preservice science teachers' self-efficacy beliefs

in regard to the teaching of science as inquiry. The results of this study may provide important information for preservice science teachers and programs.

### **70. PRE-SERVICE TEACHERS SELF-EFFICACY BELIEFS ABOUT HOW TO TEACH AND IMPLEMENT NATURE OF SCIENCE CONCEPT IN SCIENCE CLASSROOM**

B. Bezir, J. A. Dunkhase and H. Akcay  
*University of Iowa*

The purpose of this investigation is to examine pre-service science teachers' self-efficacy beliefs about nature of science, particularly their big ideas about teaching and implementing. Participants were 26 pre-service teachers who enrolled meaning of science course at the one of the Midwestern University in U.S. As a course requirement, participants were asked to prepare a lesson plan, big ideas table and reflective papers. Additionally, participants were asked to complete Nature of Scientific Knowledge Scale (NSKS) at the beginning and end of the semester. Results from quantitative and qualitative data showed those pre-service teachers' self-efficacy beliefs about teaching and implementing of nature of science concepts at the end of the course.

### **71. EVOLUTION EDUCATION AT ISU: STUDENT BELIEFS AND UNDERSTANDING**

J. W. Rice and J. T. Colbert  
*Iowa State University*

While biological evolution is taught in university biology courses and is written into most secondary biology curricula, the U.S. public still holds substantial misconceptions about this topic. Many factors likely contribute to this problem. This study sought to determine the effectiveness of instruction in biological evolution on undergraduates majoring in biology and genetics. We examined the relationship between these students' attitude toward the theory of evolution and their understanding of the theory of evolution over the course of their college-level study of the biological sciences. We found that student opinions on some evolutionary topics changed after taking one biology course, others changed after 4 years of instruction, and others remained constant. Before instruction, students with a higher level of acceptance of evolutionary theory had significantly better understanding of basic evolutionary ideas. Our findings also indicate that student understanding of the theory of evolution improves significantly after taking one biology course, and improves again by graduation. Additionally, many students provided text responses explaining their choices on the survey that reveal commonly held misunderstandings of the nature of science. We conclude that instruction in evolution can be successful even when students hold opinions that contradict the material. Finally, while instruction in evolution has no significant impact on overall student opinion of evolutionary topics, a more specific subset of opinions are significantly changed.

### **72. SECONDARY SCIENCE PRESERVICE TEACHERS BELIEFS AND PERCEPTIONS**

Z. Yakar  
*University of Iowa*

This study is focusing on changing 41 secondary science preservice teachers' philosophies, beliefs, and perceptions about constructivist teaching and learning through a four-semester sequence teacher education program in the Iowa-Secondary Science Teacher Education Program (SSTEP). The examination of preservice teachers' belief and their perceptions could provide definition for potential teacher education programs and understanding the effects of methods courses on preservice teachers will be useful as models for other teacher educators. The instruments used in this study were the Constructivist Learning Environment Survey (CLES), a Likert scale survey and Philosophy of Teaching and Learning (PTL), eight open-ended questions. The data were analyzed using One Way Analysis of Variance (ANOVA). Additionally, Tukey-HSD post-hoc tests were completed to identify the specific periods that exhibit differences for each dependent variable. All statistical data were carried out using the Statistical Package for Social Sciences (SPSS) version 10.0. Major findings indicate that preservice teachers' perceptions regarding constructivist approach become significantly and increasingly more student-centered in terms of Personal Relevance, Critical Voice, Shared Control, and Student Negotiation. Preservice teachers' conceptions concerning teaching and learning become significantly and increasingly more student-centered in terms of what students need to do to improve their understanding of science concepts.

### **73. CHANGE IN TEACHERS IDEAS ABOUT SCIENCE TEACHING AND LEARNING**

H. Akcay, B. Bezir and R. E. Yager  
*University of Iowa*

The purpose of this study was to find out how does a Science Technology and Society (STS)/constructivist learning environment affect preservice science teachers' beliefs about science teaching and learning as a result of experiences in a Societal & Education Applications of Biological Concepts course. Qualitative research method was used with and a one-group pretest-posttest design. The Philosophy of Teaching and Learning (PTL) was administered to the preservice science teachers at the beginning of the semester as pre-tests and again at the end of the semester as post-tests. The PTL was adapted from the Teacher's Pedagogical Interview (TPPI), which was developed by Richardson and Simmons in 1997. The TPPI consisted of 44 open-ended questions; however, the PTL consisted of the eight most important questions, which were selected from the TPPI to determine students' beliefs and philosophies in terms of teaching and learning. It contains eight open ended questions (Lew, 2001). The sample consists of forty-one pre-service science teachers. In order to evaluate the effects of the STS/Constructivist

approach, comparisons were made between preservice science teachers pretest and post test PTL scores. A two-way repeated measures ANOVA (one between, one within) was used to assess whether significant change had occurred over time (pre-test vs post-test) in preservice science teachers beliefs about science teaching and learning as measured by the PTL. Preservice science teachers showed statistically significant growth toward an STS/Constructivist philosophy of science teaching and learning in terms of student actions in the classroom, as well as their increased understanding of science processes and content.

## Organismal Biology Section

### POSTER PRESENTATIONS

#### 74. USE OF BARNs BY THE INDIANA BAT (*MYOTIS SODALIS*) AND OTHER BATS IN SOUTH-CENTRAL IOWA

R. Benedict<sup>1</sup>, D. Howell<sup>2</sup>, S. Benedict<sup>1</sup>, S. Bonefas<sup>1</sup> and A. Hysell<sup>1</sup>

*Central College, Department of Biology<sup>1</sup>, Iowa Department of Natural Resources<sup>2</sup>*

One barn in southeastern Iowa has been found containing a large maternity colony of *Myotis sodalis*. To determine if Indiana bats commonly use barns as day roosts in south-central Iowa, we examined barns in six counties during 2005 and 2006. Barns near forests were identified using air photos and checked during the day for bat activity. Barns with signs of recent use were then mist-netted and/or harp-trapped at sunset to determine which bats were present. During the two summers, 233 barns were checked during the day; 185 of these (79.4%) showed at least some signs of use by bats. We netted a total of 47 barns and caught 1471 bats. *Eptesicus fuscus* was most numerous (945 individuals; caught in 91.5 % of barns netted), followed by *Myotis lucifugus* (503 individuals; caught in 48.9 % of barns netted), *Myotis septentrionalis* (11 individuals; caught in 17.0 % of barns netted), and *Myotis sodalis* (10 individuals; caught in 12.8 % of barns netted). *Myotis sodalis* does not appear to use barns commonly in this region for day roosts; most individuals caught were entering the buildings at least one hour after sunset and appeared to be using them as night roosts. This possibility warrants further investigation. Barns clearly are an important resource for *Eptesicus fuscus* and *Myotis lucifugus*, both of which commonly form maternity colonies that can be quite large, numbering in the hundreds of individuals. *Myotis septentrionalis* may forage in barns; most individuals were caught flying into barns shortly after sunset.

IAS T-shirts, bags, mugs, and more  
are available 365 days a year at:  
[www.iacad.org](http://www.iacad.org)

#### 75. EFFECTS OF GENISTEIN EXPOSURE DURING CRITICAL TIME PERIODS ON MATERNAL BEHAVIOR IN SPRAGUE DAWLEY RATS<sup>PPP</sup>

M. K. Caniglia, E. R. Ball, M. Gombas, S. Knight, B. Widlund and A. B. Wisniewski  
*Drake University*

Rodent maternal behavior is influenced by fluctuating estrogen, progesterone, and prolactin levels during pregnancy and lactation. Normal maternal behavior is a key factor in the perinatal development of pups. Previous studies have shown that exposure to synthetic estrogenic endocrine-disruptors such as bisphenol A (BPA) alter maternal behavior and possibly offspring development. Less attention has been given to naturally occurring genistein and its possible effects on maternal behavior. Genistein is an estrogenic endocrine-disruptor found in soy products. This study investigates dietary genistein effects on maternal behavior during a critical period (i.e., lactation) of perinatal development in Sprague Dawley rats. Maternal behavior observations were recorded for the following activities: nursing, laying, nesting, licking/grooming pups, removal from pups, and carrying pups. We hypothesize that genistein exposure during lactation alters maternal behavior. There was a significant reduction in the percent time spent licking/grooming pups by dams exposed to genistein during lactation compared to those never exposed to genistein. We reject our null hypothesis. Dietary exposure to genistein during lactation is detrimental to specific maternal behaviors (i.e., licking/grooming) but not other maternal behaviors. This could have confounding effects on concurrent genistein studies.

#### 76. USING CLOMELEON TO IMAGE CHLORIDE DYNAMICS IN TRANSGENIC *CAENORHABDITIS ELEGANS*

N. Rotella, L. Meyer and R. L. Dunbar  
*Buena Vista University*

Chloride ions serve many physiological functions, including stabilization of the resting membrane potential, intracellular pH levels, and cell volume. However, measuring intracellular chloride concentrations has proven to be problematic. Clomeleon, a ratiometric indicator of chloride concentration, was created in the Augustine Laboratory at Duke University. Clomeleon works by measuring the fluorescence resonance energy transfer (FRET) from a chloride-insensitive cyan fluorescent protein fused with chloride-sensitive yellow fluorescent protein. The Clomeleon gene has been integrated into the pPD\_30 plasmid which contains the myo-2 promoter. Once this plasmid is integrated into the DNA of a *Caenorhabditis elegans*, by means of a microinjection, we will have the necessary transgenic worms to further our research. These transgenic *C. elegans* with Clomeleon expression, which driven by the myo-2 promoter will be used to image changes in chloride concentration dynamics associated with a mutation in a glutamate-gated chloride channel. Specifically we will address the hypothesis that intracellular chloride con-



centrations within neurons will be different in *C. elegans* with the *avr-15* (ad1051) mutation when compared to the wild type. Future goals include imaging chloride dynamics across populations of neurons.

**77. DETERMINING THE ROLE OF GLUTAMATE-GATED CHLORIDE CHANNEL RECEPTORS IN LONG TERM HABITUATION IN *CAENORHABDITIS ELEGANS***

S. N. Wyatt, M. A. Spitz, D. D. Nelson, Z. C. Gernhart, C. B. Peters and R. L. Dunbar  
*Buena Vista University*

*Caenorhabditis elegans* have been shown to habituate to a tap stimulus and commit that habituation to long term memory. Studies with *eat-4*, a gene for pre-synaptic glutamate vesicle transport, and *glr-1*, a glutamate gated AMPA homolog receptor, have shown that glutamate is necessary for long term memory formation in *C. elegans*. Interneurons in the circuit underlying the habituated tap withdrawal response are known to be the site of glutamate-gated chloride channels (GluCl). Using GluCl mutants, we have shown these channels to be important for the retention of long term habituation. We hypothesize that treatment with a glutamate agonist as well as with a glutamate antagonist will cause worms to be deficient in long term habituation to the tap withdrawal response. To investigate the role of the GluCl in long term habituation using a pharmacological approach, we are administering each drug independently to a population of *C. elegans*. Post administration, we are assaying habituation using behavioral trials. Behavioral trials are the exact trials which have previously been used to show long term habituation to tap. The lab is currently utilizing a plate selection assay to determine effective concentrations of each drug for behavioral trials.

Mark your calendars!

**2007 ISTS Fall Conference**

Thursday, October 18th, 2007

at the Crowne Plaza Hotel, Cedar Rapids

The ISTS Conference is Iowa's largest meeting for science educators.

## Organismal Biology Section

### ORAL PRESENTATIONS

**78. CALCIUM OXALATE LEAF CRYSTALS AND THEIR MACROPATTERNS IN 45 SPECIES OF PEPEROMIA (PIPERACEAE): ANATOMICAL AND PHYLOGENETIC IMPLICATIONS**

H. T. Horner  
*Iowa State University*

Leaves from greenhouse-grown and herbarium species of *Peperomia* vary considerably in shape, thickness, lamina size, and coloration. Selection of species for this study matched a 2006 published phylogram based on two chloroplast gene profiles. Leaves display between their adaxial and abaxial epidermises an upper multi-layered, large-celled hypodermis of water-containing cells, immediately below which is a small, green, typically single-layered palisade parenchyma. This layer is sandwiched between hypodermis and spongy mesophyll containing vasculature. Clearings and vibratome sections show a multitude of calcium oxalate crystal idioblasts that individually contain druses, and sometimes prisms or bundles of raphides. Druses, specifically and consistently occur singly in palisade cells, and form a uniform or reticulate macropattern that is species specific. In contrast, prisms or bundles of raphides, when present, generally occur in the spongy mesophyll and also are species specific. Variations in the occurrence of these three types of crystal forms represent a very intriguing internal taxonomic indicator when applied to existing molecular data. Druses, spherical aggregates of crystals, also vary from one species to another in terms of their average diameters, and number and shape of individual crystal facets. as shown by light microscopy in conjunction with crossed polarizers, and by scanning electron microscopy. These druses in the photosynthetic palisade parenchyma may have a special function in light gathering and reflection under subdued light. The data will be discussed in terms of the observed seven crystal macropatterns and their taxonomic associations within this basal, pantropical genus.

**79. THE EFFECTS OF GREEN TEA ON TADPOLE DEVELOPMENT**

M. R. Heber, W. M. Olson and L. A. Beltz  
*University of Northern Iowa*

The effects of green tea in living organisms have been the source of much research, both in adult and developing systems. It is known that green tea can have antioxidative effects or pro-oxidative effects, depending on its dosage. We studied the effects of green tea on larval *Xenopus laevis* development when exposed to crowding stress. Neurulation stage tadpoles (Nieuwkoop and Faber stage 25) were collected and randomly assigned to one of the four conditions: non-crowded water, non-crowded tea, crowded water, and crowded tea. Water changes and mortality counts were conducted daily, and in some trials

a hydrogen peroxide assay was done daily with samples from each experimental group before and after treatment change. Once the tadpoles reached feeding stage (N&F stage 45), they were anaesthetized and preserved in 10% neutral buffered formalin for analysis. Snout-vent lengths and total lengths were recorded for each tadpole, and they were assessed for abnormalities. Tadpoles exposed to green tea were significantly smaller (reduced snout-vent length) than the control populations both in crowded and non-crowded conditions, but also had slightly lower mortality rates. Hydrogen peroxide is naturally present in the tea, but the assays indicate that the tadpoles are able to degrade it. There may be a tradeoff between survivorship and increased incidence of morphological abnormalities.

**80. SHOOT DEVELOPMENT IN *AMPELOPSIS JAPONICA* [VITACEAE]**

L. H. Trebbien and J. M. Gerrath  
*University of Northern Iowa*

The Vitaceae contains 14 genera and about 750 species. *Ampelopsis brevipedunculata*, native to Northeastern Asia, is the only species in this genus that has been studied developmentally. *A. japonica* is also native to China and East Asia. Molecular studies have divided the genus into two clades, which correlates to having simple or compound leaves. We would predict that this taxon would be in the same clade as *A. brevipedunculata*, since both have simple leaves. Shoot development in *A. japonica* has not been previously studied and will be compared to that of *A. brevipedunculata*. Shoot apices were harvested from greenhouse-grown plants and dissected to examine the meristems at various stages using scanning electron microscopy. Growth pattern, general morphology, initiation and early development of primordia were recorded. *A. japonica* has entire leaves with acute tips, serrate margins, and a caudate base. It has an interrupted tendril pattern, with a missing tendril at every third node, which is different from *A. brevipedunculata*. Under magnification, an axillary primordium with an aperture is initiated, which is similar to supernumerary bud formation in *A. brevipedunculata*. This study shows differences between the two species, but corroborates the hypothesis that they belong in the same clade.

IAS was founded in 1876, which was before the discovery of the electron, the detection of radio waves, the use of radioactivity to date the Earth, and the development of germ theory. For all of this and more, IAS was there.

**Physics, Atmospheric & Space Sciences Section**  
**POSTER PRESENTATIONS**

**81. WATER ADSORPTION AND UPTAKE IN ATMOSPHERICALLY RELEVANT PARTICLES: ATR-FTIR SPECTROSCOPY AND QCM MEASUREMENTS**

J. Schuttlefield and V. H. Grassian  
*University of Iowa*

ATR-FTIR spectroscopy along with a Quartz Crystal Microbalance (QCM) is used to investigate and quantify the uptake of water on atmospherically relevant particles. Spectral analysis along with mass changes calculated from QCM data are used to examine the water content of these particles as a f(RH). Atmospherically relevant particles investigated in these studies include salts, oxides, clays, and zeolites. For these various types of particles, water can: (i) adsorb on the particle surface; and/or (ii) absorb in the particle structure to form a hydrate salt; and/or (iii) absorb by the particle to form a liquid solution (or deliquesce); and/or (iv) absorb in the internal structure for some clay minerals. ATR-FTIR spectra can be used to distinguish these various processes, and when coupled with a QCM, the amount of water associated with the particles as a function of relative humidity can be quantified.

**Physics, Atmospheric & Space Sciences Section**  
**ORAL PRESENTATIONS**

**82. RADIO REMOTE SENSING OF THE SOLAR CORONA**

S. R. Spangler  
*University of Iowa*

The solar corona is the low density, very high temperature outer layer of the Sun's atmosphere. It forms the base of the solar wind, which flows out into interplanetary space past the Earth and permits solar disturbances to affect our planet. The primary scientific mystery about the corona is the mechanism or mechanisms responsible for heating it to its temperature of 1 - 2 million degrees Kelvin, as opposed to 5800 degrees Kelvin for the photosphere, or visible disk of the Sun. Most current theories rely on a heating role for turbulence in the corona, or heating from electrical currents associated with the coronal magnetic field. Evaluation of these theories requires measurements of coronal turbulence and magnetic fields. I will describe my program of research at the University of Iowa to measure these coronal characteristics using radioastronomical remote sensing measurements. The projects have used the Very Large Array and Very Long Baseline Array radio telescopes of the National Radio As-

tronomy Observatory to observe natural radio sources through the corona, and measure the effect of the corona on their radio waves. The observations show the presence of coronal turbulence and electrical currents, but neither seem strong enough to account for the required heating rate.

## Physiology & Health Sciences Section

### POSTER PRESENTATIONS

#### **83. EXPOSURE TO GENISTEIN DURING DIFFERENT CRITICAL TIME PERIODS DURING PERINATAL DEVELOPMENT RESULTS IN PHYSIOLOGIC ABNORMALITIES DIFFERENTLY IN MALE AND FEMALE RATS<sup>PPP</sup>**

E. R. Ball, M. K. Caniglia, S. Knight, M. Gombas, E. Widlund and A. B. Wisniewski  
*Drake University*

Exposure to environmental chemicals, termed endocrine disruptors, which interfere with endogenous hormone physiology, is of major health concern. The phytoestrogen genistein has been of great interest due to its potential to induce harmful effects despite its promotion as a health product. Research in humans shows a correlation with a maternal vegetarian diet and hypospadias, and a rodent model shows that exposure to genistein during both gestation and lactation exerts long-lasting effects on the reproductive and immune systems in males, but little attention has been given to females. The aim of the present study was to identify critical time periods of exposure, during perinatal development, that result in abnormalities of external genitalia, sex ducts, gonadal development, and relative mass of immune organs in male and female rats. Sprague-Dawley rat pups were exposed to genistein during gestation and/or lactation via maternal consumption of rat chow mixed with genistein (5 mg/kg feed). Reproductive measures were assessed during postnatal and pubertal development through adulthood. Immune organs were also extracted for examination. Male anogenital distance and postnatal body mass were reduced in male pups exposed during both gestation and lactation, whereas only postnatal body mass was reduced in animals exposed during lactation only ( $p < 0.05$ ). No other reproductive abnormalities were seen in males or females during puberty or adulthood. Relative spleen mass in adulthood was altered differently in males and females ( $p < 0.05$ ). Exposure to genistein during different critical time periods results in alterations of different physiological measures. Furthermore, sex differences should be considered in future research.

#### **84. EFFECTS OF "CONTEXT" ON PHYSIOLOGICAL RESPONSES TO RACIAL EPITHETS**

M. Golnitz, A. Andrews and R. L. Dunbar  
*Buena Vista University*

Different stimuli, such as images or words, provoke different types of physiological reactions in each individual. Our research will investigate and analyze these reactions to assess the hypothesis that physiological responses to racially-charged words will change based on emotive influences in the environment. Student volunteers at Buena Vista University will be shown random images of faces in one of three emotive states, one of five racially-charged words, or a combination of the two. Specific indicators of physiological stress will be monitored and recorded, including heart rate and galvanic skin response. Data analysis will determine whether a reaction to a word is altered when it is paired with any of the emotive states. The experiment will aid in our understanding of the perception of words and images in different contexts at the physiological level. The data collected can then be used to design future experiments using other types of epithets.

#### **85. EFFECTS OF CREATINE SUPPLEMENTATION ON MUSCLE FATIGUE AND RECOVERY TIME MEASURED USING GRIP TEST**

N. B. Krause, E. L. Whited, L. C. Czyzewicz, C. M. Dirkx, J. L. Staley and R. L. Dunbar  
*Buena Vista University*

Creatine loading has become a nation-wide trend based on the premise that increasing creatine concentration in skeletal muscle cells will result in an increase in available energy. This premise stems from the biochemical relationship between creatine concentrations in the form of creatine phosphate (PCr) and subsequent production of ATP from ADP. Our project involves orally ingested creatine and is divided into two elements. The first is analyzing data from our previous experiment measuring power output using the jump test. The second is measuring fatigue and recovery time using a grip force test. We will be measuring the fatigue acquired during grips of various duration as well as muscle recovery between grips of maximal force. Test subjects will be randomly selected. Experimental group will receive 0.3 gram/kilogram creatine of body weight. The control group will receive a placebo. The participants are required to maintain a constant lifestyle throughout the creatine phase. Tests will be performed before and after a creatine regimen of 19 days. The results between the experimental group, which received creatine and the control group that did not, will be compared. For testing fatigue and recovery time, a grip test will be performed, using a hand force dynamometer. Our hypothesis is that participants will have decreased muscle fatigue and recovery time after creatine supplementation.

Did you know that the IAS Logo was created for the 100th Anniversary of the Academy? Each of the images in the logo has a specific symbolism. Visit the IAS website at [www.iacad.org](http://www.iacad.org) to find out more!

# Physiology & Health Sciences Section

## ORAL PRESENTATIONS

### **86. PHARMACOLOGICAL EFFECTS OF THE AQUEOUS EXTRACT OF *CAULOPHYLLUM THALICTROIDES* (BLUE COHOSH) ON ISOLATED MUSCULUS UTERI<sup>BBP</sup>**

J. Berger and T. DeGolier  
*Bethel University*

The roots and rhizomes of *Caulophyllum thalictroides* (blue cohosh), traditionally used as an aid for childbirth, contain several active alkaloids and saponins, which act directly on uterine smooth muscle resulting in an oxytocic response. The historical use of this herbal supplement has been well documented, but there are few clinical studies addressing its efficacy and potential side effects. This research investigated the physiological and pharmacological responses of blue cohosh on isolated strips of murine uterine tissue. Uterine horns from mice were suspended in a smooth muscle bath and exposed to the aqueous extract of blue cohosh (0.037-23.8 mg). All tissues showed an increase in the strength of contractile force and these forces were significantly greater with higher doses ( $P=.0001$ ). The stages of estrous were determined by vaginal smears and dose-dependency was consistent in all stages of estrous observed (diestrus, estrus, metestrus). Blocking experiments showed that uterine tissues given a control dose of blue cohosh, followed by the nicotinic receptor antagonist curare, resulted in a 70% decrease in contractile response following a second application of blue cohosh. This is consistent with the proposed mechanism for blue cohosh.

### **87. CHARACTERIZATIONS OF M. TUBERCULOSIS DERIVED PEPTIDE IN CONTEXT OF MULTIPLE HLA ALLELES<sup>BBP</sup>**

C. Conway  
*Central College*

About two billion people, or one-third of the human population, are currently infected with *Mycobacterium tuberculosis* (MayoClinic.com). The only anti-tuberculosis vaccine currently available is bacillus Calmette-Guérin (BCG) vaccine. There is a region of difference, a 9.5kb DNA segment, which is deleted from all BCG sub-strains and yet is present in *Mycobacterium tuberculosis* (Mustafa, 2001). This region encodes for the secretion of many proteins, including ESAT 6 and CFP 10. These proteins are of interest because they are recognized from a high percentage of people with latent tuberculosis, they stimulate T cells to produce interferon gamma and they exhibit cytotoxic T-lymphocyte activity in models infected with *Mycobacterium tuberculosis* (Porsa, et al., 2005). In this experiment four peptides: ESAT 6: 31-45 and 46-60 and CFP 10: 16-30 and 41-55 were used and the T-cell response of thir-

teen different knockout-transgenic mice was noted. Single transgenic mice, including DQ8, DQ6\*0601, DQ6\*0604, DRB1\*1501, DRB1\*1503, DR3, DRB1\*0401, and DRB1\*0402 were used along with double transgenic mice strains DR3/DQ8, DRB1\*0401/DQ8, and DRB1\*0402/DQ8. T-cell response varied with mouse strain. Use of both double and single transgenic mice allows for possible insights to reactions between the alleles. Double transgenic mice whose single transgenic counterparts had one allele which responded highly to ESAT 6 peptides and one which did not, showed a decreased response to the peptide. This pattern was not always true however, for double transgenic mice responding to the CFP 10 peptides.

### **88. THE EFFECTS WHEY PROTEINS HAVE ON THE ACTIN FIBRILES IN EXERCISED FEMALE MUSCULUS<sup>BBP</sup>**

A. Karl  
*Saint Mary's University of Minnesota*

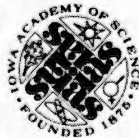
Whey proteins from milk are a natural source of nearly all the essential and non-essential human amino acids. Whey proteins supply the amino acids that are a precursor for building muscle (Wikipedia). This study will set out to determine whether or not the consumption of whey protein and exercise will increase actin muscle fibriles in female CD-1 mice because whey proteins are well known to build muscle, enhance endurance, and reduce muscle deterioration. Four groups of five female mice will be formed. There is an exercise control group and a non-exercise control group that will both be given tap water. The experimental groups are composed of an exercise group and a non-exercise group that will both be given whey proteins obtained from GNC. The exercise routine will consist of running in exercise balls and swimming every other day, for 10 minutes each day, over a span of five weeks. They are doing two forms of exercise so the mice are able to work different muscles in their body. All groups will be given unlimited amounts of food. The mice will be weighed as soon as received, prior to exercising each day, and before euthanized. After the testing period, the mice will be euthanized and the triceps brachii and quadriceps femoris will be excised. Western blot will be used to analyze actin levels between treatment groups. The measured relative amounts of protein present in each muscle will be analyzed by ANOVA to determine the effect of exercise and whey protein supplement.

### **89. MEASURING INTENTIONAL BEHAVIOR IN PRIMATES**

A. Schnedler, T. Shemak, T. Griggs, S. Boyce and D. Birmingham  
*Central College*

Increasingly, researchers are learning about cognitive behavior by studying primates. Studying cognition in any species requires creatively designed methods. Although a number of valid and reliable methods exist for studying human cognition, most of these rely heavily on verbal

communication between the experimenter and the participant. Such a convenience is not immediately available when the experimenter is human and the participant is not. One difficulty in primate cognitive research is developing methods that accurately detect primate cognitive abilities (Rumbaugh & Washburn, 2003; Shumaker & Swartz, 2002). Greenfield and Lin (2007) summarize work in the area of intentional behavior in younger primates. Our goal is to extend this research in primates by examining potential age-related changes in intentional behavior, focusing closer to the midpoint of their lifespan. This presentation will describe a procedure for measuring intentional behavior in bonobos (*Pan paniscus*) and potential concerns regarding such research.



We hope that you have enjoyed the 119th Iowa Academy of Science Annual Meeting. Please plan to join us next year at Kirkwood Community College.

# Author Index

Author	Abstract Number	Author	Abstract Number	Author	Abstract Number	Author	Abstract Number
Ahrendsen, A.	3	Cordell, J. L.	1	Kambhampati, S.	17	Schuttlefield, J.	81
Akçay, H.	69, 70, 73	Czyzewicz, L. C.	85	Karakaya, I.	48	Schwartz, P.	53
Alstott, J.	5	Dant, M.	18	Karl, A.	88	Sease, M.	7
Amin, V.	45	Debinski, D.	34	Karra, P.	50	Shellabarger, R.	28
Anderson, L.	32	Deckert, A.	15	Kelderhouse, L. E.	54	Shemak, T.	89
Anderson, R. R.	68	DeGolier, T.	86	Kemmet, S.	41	Shivanna, K. H.	43
Andjelkovic, D.	47	Dhanwada, K. R.	57	Kendall, B.	2	Shriver, J. A.	19, 20
Andrews, A.	84	Dirkx, C. M.	85	Kim, C.	53, 56	Shriver, S.	21
Applegate, T. R.	19	Divino, J. N.	4, 26	Knight, S.	52, 75, 83	Simpson, J. L.	10
Arnold, M.	22	Dix, A.	48	Kolb, A.	29	Skinner, G. A.	37
Austin, A. L.	57	Dockter, D.	29	Krause, N. B.	85	Sleister, H.	6
Bafna, R. R.	44	Doyungan, Z. F.	17	Leichty, R. J.	37	Smith, D.	35
Ball, E. R.	75, 83	Drgon, T.	13	Leonard, K.	3	Smith, E.	64
Bartusek, E.	58	Dunbar, R. L.	76, 77, 84,	Lewis, D. Q.	38	Spangler, S. R.	82
Beason, S. R.	65		85	Logan, C.	5	Spitz, M. A.	77
Beeman, R. W.	17	Dunkhase, J. A.	70	Long, T.	45	Staley, J. L.	85
Beltz, L. A.	79	Elkin, E. H.	27	Lorenz, F. O.	39	Staloch, E.	21
Benedict, R.	74	Ellenwood, R. J.	67	Loux, M. K.	62	Sundararajan, S.	47
Benedict, S.	74	Emerman, S. H.	37, 67	Lytle, J.	3	Tadepalli, S.	43
Bennett, M. R.	67	Esbaum, K. L.	10	Magnotta, V. A.	43, 44	Timmons, S.	56
Berg, K.	9	Fischer, N. L.	46	McClure, S.	45	Tonn, W. M.	26
Berger, J.	86	Fosdick, L.	21	McCullough, D. A.	28	Tracy, T. T.	29, 30
Birmingham, D.	89	Fulk, N.	3	McCullum, A.	31	Trebien, L. H.	80
Bernstein, N.	31	Fulton, G.	25	McDonald, A.	5	Twining Gerdes, E.	54
Bezir, B.	70, 73	Furlong, L.	33	McDonald, E.	5	Vander Broek, E.	29, 30
Bhuyan, S. K.	47	Gautam, S.	51	McDonnell, A.	53	Voight, J.	12
Bill, N. L.	20	Gernhart, Z. C.	77	Meyer, K.	41	Walters, J. C.	62
Bilski, M.	14	Gerrath, J. M.	80	Meyer, L.	76	Watkins, D. L.	22
Bixler, A.	59	Gerriettes, J.	5	Mina, M.	41	Weeks, R.	29, 30
Bjorge, A. M.	4	Giles, J.	11	Mino, R. A.	54	Weihe, P. E.	27, 60
Black, R.	31	Golnitz, M.	84	Moran Portillo, D.	5	Welch, R. L.	35
Boersma, J.	29, 30	Gombas, M.	75, 83	Muhs, R.	3	Whited, E. L.	85
Boggess, T.	22	Grassian, V. H.	81	Nelson, D. D.	77	Whitman, J.	31
Bohnsack, B.	56	Griggs, T.	89	Nydegger, I.	23	Widlund, B.	75, 83
Bonefas, S.	74	Grosland, N. M.	43, 44	O'Brien, K.	16	Williams, D.	35
Bowler, N.	46	Groves, J. R.	63, 66	O'Brien, S. R. M.	39	Wilson, W. A.	8
Bowzer, J.	60	Hampton, J.	5	Olesberg, J.	22	Wisniewski, A. B.	52, 75, 83
Boyce, S.	89	Hangartner, A.	5	Olson, W. M.	79	Witzke, B. J.	68
Boyer, M. P.	8	Harris, E. W.	27	Orlofske, J.	34	Wright, M. M.	42
Brady, T.	32	Haugen, S.	3	Paschkewitz, T. M.	24	Wu, L.	45
Bragg, A. C.	50	Haustein, C.	55, 60	Pease, J. L.	39	Wyatt, S. N.	77
Brice, S.	54	Hawkins, L. R.	67	Peters, C. B.	77	Yager, R. E.	73
Brittingham, A.	4, 7	Heber, M. R.	79	Ratner, A.	48, 49	Yakar, Z.	69, 72
Brittingham, J.	10	Heise, M. M.	45	Reisdorph, S.	63	Zhang, X.	49
Brown, R. C.	42	Hemsath, C.	36	Rice, J. W.	71		
Buhl, C.	3	Henry, M. K.	11	Rose, J.	5		
Cabib, E.	13	Holden, L. S.	47	Rotella, N.	76		
Campbell, J. F.	17	Horgen, S. E.	1	Ruggie, B.	6		
Caniglia, M. K.	75, 83	Horner, H. T.	78	Rusdianto, E.	6		
Cannon Jr., D. M.	23, 24	Howell, D.	74	Sandberg, S.	40, 60		
Chandra, A.	50	Hruby, C.	52	Schledewitz, K.	55		
Christian, A. J.	60	Hysell, A.	74	Schmidt, M.	13		
Colbert, J. T.	71	Iqbal, M. Z.	51	Schnedler, A.	89		
Conway, C.	87	Jackson, L. L.	36, 38	Schnee, F.	59		



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

Iowa Academy of Science  
175 Baker Hall—UNI  
Cedar Falls, Iowa 50614-0508  
(319) 273-2021  
<http://www.iacad.org>