Iowa Academy of Science 115th Annual Meeting [Program, 2003]

Iowa Academy of Science

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IOWA ACADEMY OF SCIENCE

115th ANNUAL MEETING
April 25 - 26, 2003

Hotel Fort Des Moines
Des Moines
A Special Thank You

The Iowa Academy of Science and the Iowa Science Foundation wish to thank the following for their generous support of this meeting and other IAS research-related activities that benefit all Iowans:

American Journal of Undergraduate Research
Iowa Child
Iowa Energy Center
Iowa Primate Learning Sanctuary
Iowa Space Grant Consortium
John Deere & Co.
Krell Institute
Pella Rollscreen Foundation
University of Iowa Press
Virtual Reality Applications Center

ACKNOWLEDGEMENTS

The Iowa Academy of Science and its Board of Directors wish to thank The Hotel Fort Des Moines for providing the excellent service and facilities for the Annual Meeting. The Hotel administration and staff have been exemplary.
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PROGRAM SUMMARY

THURSDAY, April 24, 2003

6:00 p.m. Board of Directors
Dinner & Meeting

FRIDAY, April 25, 2003

7:30 - 12:00 noon & 1:30 - 4:00 p.m. REGISTRATION Mezzanine (2nd Floor)

8:00 - 10:30 a.m. SYMPOSIUM: Wedgwood Room
Iowa's Energy Future
Organized by Thomas D. Wheelock & Bion L. Pierson, Iowa State University

8:00 - 10:30 a.m. SYMPOSIUM: Capital Room
The Natural History, Conservation and Restoration of Freshwater Mussels in the Upper Midwest
Organized by David L. Lyon, Cornell College

8:15 - 10:15 a.m. SPECIAL PANEL Room 310
Emerging Animal-Borne Diseases in Iowa: West Nile and Beyond
Russ Currier, Iowa Department of Public Health; Juergen Richt, National Animal Disease Center, USDA; David R. Mercer, University of Northern Iowa

8:00 - 10:00 a.m. Anthropology Room 312

8:00 - 10:30 a.m. Botany Room 308

8:00 - 9:40 a.m. Environmental Science & Health Room 318

8:00 - 5:00 p.m. IAS & IJAS POSTER DISPLAYS North Room

8:30 - 10:30 a.m. IJAS ORAL PRESENTATIONS Room 302

10:30 - 11:45 a.m. GENERAL SESSION I State Room
The Arizona Project: Excavation of an Early Greek City on Crete
Dr. Margaret S. Mook, Iowa State University

12:00 noon AWARDS LUNCHEON Grand Ball Room
This luncheon will honor groups and individual students who have performed in an exemplary manner in science activities throughout Iowa. Four teachers will be honored as they receive the Iowa Academy's Excellence in Science Teaching Award.

1:45 - 2:15 p.m. STANDING COMMITTEE MEETINGS Room 320

2:00 - 3:00 p.m. IOWA JUNIOR ACADEMY OF SCIENCE TOUR Iowa State University
The Virtual Reality Applications Center
2:15 - 2:45 p.m.  IAS MEMBERSHIP BUSINESS MEETING

2:15 - 5:20 p.m.  Engineering

4:00 - 5:00 p.m.  IAS POSTER PRESENTATIONS

5:00 - 6:00 p.m.  SOCIAL HOUR
IAS Authors Book Signing

6:00 - 8:00 p.m.  PRESIDENT'S BANQUET

8:00 - 9:00 p.m.  GENERAL SESSION II
When Muscle Mattered Most: The Biomechanics of Some Ancient Tasks
Dr. Steven Vogel, Duke University

SATURDAY, April 26, 2003

7:30 - 10:30 a.m.  REGISTRATION

8:00 - 10:20 a.m.  Cellular, Molecular & Microbiology and Physiology

8:00 - 10:00 a.m.  Chemistry: Inorganic, Physical & Analytic

8:00 - 10:00 a.m.  Chemistry: Organic & Biological

8:00 - 10:20 a.m.  Conservation

8:00 - 10:40 a.m.  Geology

8:40 - 10:20 a.m.  Physics (AAPT Meeting)

8:15 - 10:30 a.m.  Zoology

8:00 - 10:30 a.m.  IAS POSTER DISPLAYS

10:30 - 11:45 a.m.  GENERAL SESSION III
Molecular Basis of Muscular Dystrophy and Approaches to Therapy
Dr. Kevin Campbell, University of Iowa, Howard Hughes Medical Institute

12:00 noon  SATURDAY LUNCH
Area restaurants opened for lunch on Saturday:
Raccoon River Brewing Company - next door to the hotel
Spaghetti Works - 310 Court Aveune (about 7 blocks from the hotel)
Court Avenue Brewing Company - 309 Court Avenue (across from Spaghetti Works)
Allie's Restaurant - 2nd floor of Marriott Hotel (7th and Grand)
Quizno's Subs - 319 7th Street (7th & Walnut)

1:30 p.m.  Flora of Iowa discussion
Margaret S. Mook
Field Director, The Azoria Project
Chair, Classical Studies Program and Associate Professor, Classical Studies,
Department of Foreign Languages and Literatures, Iowa State University

Margaret S. Mook leads an excavation on the Grecian island of Crete called the Azoria Project, an ongoing study of urbanization on Early Iron Age and Archaic Crete, circa 1200 to 480 B.C. Mook supervises all excavations and processing of pottery found at Azoria.

The location's long-term occupation provides a rare glimpse into a community's organization through time, enabling Mook and colleagues to define Azoria's urban characteristics and to interpret the changing cultural identity of its inhabitants. Mook and her collaborators are looking closely at the history and development of this single urban site, a nascent city-state, or polis, to understand how island's inhabitants related with each other, their local environment and the larger, culturally complex and ethnically diverse eastern Mediterranean region.

Mook's research interests include ceramic technology, site-formation processes, architecture and Early Iron Age social structure. Since 1984, she has supervised excavations on Crete at the Early Iron Age sites of Vronda and Kastro and is now publishing her work on the pottery from the Kastro settlement and editing a synthesis of its remains. She holds a doctorate in classics from the University of Minnesota.
When Muscle Mattered Most: The Biomechanics of Some Ancient Tasks

Steven Vogel
James B. Duke Professor, Department of Biology, Duke University

Steven Vogel explores the intersections of biomechanics, human technology and human culture. His latest book, *Prime Mover*, looks at how the performance of muscle as an engine has shaped human history and prehistory, while his previous book *Cats’ Paws and Catapults* compares the mechanical technologies of humans and of nature.

Vogel has built a scientific career on analyzing the mechanical factors behind the designs of organisms, in particular at their fluid-dynamic devices. He has, for instance, considered the aerodynamics of especially small insects, convective cooling of broad leaves in near-still air and at drag minimization of the same leaves in storm-level winds, ways that organisms from sponges to burrowing rodents use velocity gradients to induce flows through themselves or their domiciles, and ways that organisms such as squid and whales use flow-induced pressures to re-expand their mantle and oral cavities.

He has written articles for a variety of popular magazines as well as several other books, which include a textbook on biological fluid dynamics (*Life in Moving Fluids*), a more general book on biomechanics (*Life’s Devices*) and a less academic book on circulatory systems (*Vital Circuits*). He is finishing an undergraduate textbook on biomechanics. He joined the Duke faculty in 1966, after receiving his doctorate at Harvard.
Kevin P. Campbell
Roy J. Carver Professor, Interim Head, Physiology and Biophysics Department,
University of Iowa Carver College of Medicine, Iowa City
Howard Hughes Medical Institute Investigator

Kevin P. Campbell is a leading authority on muscle physiology and muscle diseases. Since joining the University of Iowa faculty in 1981, Campbell has presented more than three hundred invited seminars and lectures internationally and has produced as many papers.

His laboratory has elucidated an essential structural complex in muscle called DGC, the dystrophin-glycoprotein complex. Defects in genes that code for a number of DGC components lead to muscular dystrophic diseases, in which skeletal muscle becomes progressively weakened and heart muscle damaged. He and colleagues are hopeful that understanding the molecular pathway that leads to muscular dystrophy will lead to therapies.

This past year alone, his ground-breaking studies published in the journals *Nature* and *Cell* have advanced the field immeasurably. In one experiment, he showed that defects in enzymes processing the muscle-repair protein dystroglycan lead to rare forms of muscular dystrophy. He followed that up by discovering that a group of stem-cell-like bodies in muscles of mice that had been genetically programmed to get muscular dystrophy were in fact making dystroglycan and repairing muscle damage induced by the disease.

Campbell received his bachelor’s degree in physics from Manhattan College and his master’s and doctorate in biophysics from the University of Rochester School of Medicine and Dentistry. He did postdoctoral studies with David MacLennan at the Banting and Best Department of Medical Research, University of Toronto. He is a member of the National Academy of Sciences Institute of Medicine.
SYMPOSIA

The Natural History, Conservation and Restoration of Freshwater Mussels in the Upper Midwest

Friday, April 25, 8:00 a.m. - 10:30 a.m. ~ Capital Room
Organizer: David L. Lyon, Cornell College

Freshwater mussels are perhaps the least studied yet most endangered animals in the United States. The mussel population’s rapid decline demands urgent attention, now. Research has long languished, likely because shellfishes lack the charisma of other endangered species. But the research climate is changing, and recent studies show that dams, pollution and especially stream degradation from soil erosion, channeling and silt build-up have led to a catastrophic decline in mussel reproduction. This session explores the latest research and ways to reverse the decline.

“The silence of the clams: historical changes in freshwater mussel biodiversity of North America and the Upper Midwest”
Kevin Cummings, Illinois Natural History Survey

“Threatened by industry, saved by science: mussel propagation at the Fairport Biological Station, 1914-1934”
James Pritchard, Department of Natural Resources Ecology & Management, Iowa State University

“Discordant harmonies in fingernail clam populations of Mississippi backwater lakes”
Jim Eckblad, Department of Biology, Luther College

“The status of freshwater mussels in Iowa’s reach of the Mississippi following the invasion of the exotic zebra mussel”
Scott A. Gritters, Iowa Department of Natural Resources

“Saving the Higgins’ Eye Pearlymussel from extinction”
Gary Wege, U.S. Fish and Wildlife Service, Twin Cities Ecological Field Office, Minneapolis

“Application of genetic techniques to aid conservation of freshwater mussels: the federally endangered Higgins’ Eye Pearlymussel as an example”
Bonnie S. Bowen, Department of Zoology and Genetics, Iowa State University

“Relationship of declining mussel biodiversity to stream-reach and watershed characteristics in agriculturally impacted streams”
K. Elizabeth Poole, Department of Animal Ecology, Iowa State University

“Assessment of mussel populations in the Cannon River drainage and Superior National Forest, Minnesota”
G. E. Wagenbach, Department of Biology, Carleton College

“Aspects of an interior stream clam midden from 1913”
D. W. Schlicht, Cedar Rapids Washington High School
SYMPOSIA

Iowa's Energy Future

Friday, April 25, 8:00 a.m. - 10:30 a.m. ~ Wedgwood Room
Organizers: Thomas D. Wheelock and Bion D. Pierson, Iowa State University
Sponsored by the Iowa Energy Center

As recent world events underscore, the United States must develop energy sources other than oil. These choices range from wind and animal waste to such novel technologies as switchgrass-fed hydrogen fuel cells. A group of leading experts will discuss alternative sources of energy and policies that look particularly promising for Iowa's energy future. The organizers and the Iowa Academy of Science thank the Iowa Energy Center for its support of this symposium.

“Fuels and chemicals from biomass”
Norm Olson, Iowa Energy Center

“Carbon trading, greenhouse gas emissions, and life cycle engineering of Iowa biomass projects”
Jerald Schnoor, University of Iowa

“Hydrogen from biomass gasification”
Robert Brown, Iowa State University

“Biodiesel as a transportation fuel”
Jon VanGerpen, Iowa State University

“The future role of wind energy in Iowa”
Tom Wind, Energy Consultant

“Solar energy: past, present and future”
Laurent Hodges, Iowa State University
In the broadest sense imaginable, most non-genetic human diseases come from animals. Some animal diseases, for reasons of evolution and geography, pose little threat to people. Others are more direct and pose the greatest danger in areas where humans, host, vector and reservoir species live near one another. In Iowa over the past few years alone, humans have become infected by animal-borne diseases ranging from hantavirus to rabies to West Nile virus. Last fall, butchers throughout Iowa worried whether to handle venison for fear of contaminating their shops with the deer version of the mad cow disease that crippled the British beef industry. Were the butchers' concerns justifiable from the scientific evidence? What about Iowa's burgeoning swine population? What are the public health implications of a swine-to-human disease outbreak in Iowa's thriving pork industry? And as the mosquitoes emerge this spring and summer, what is the prognosis for the West Nile virus, which reached Iowa with fatal consequences last year? Are there other mosquito-borne diseases heading our way? A panel of experts will take on these questions and others.

"Overview"
Russ Currier, Iowa Department of Public Health

“Animal prion diseases and swine influenza: wasting brains and coughing pigs”
Juergen Richt, National Animal Disease Center, USDA

“West Nile Virus: have we seen the worst?”
David R. Mercer, Department of Biology, University of Northern Iowa
2003
IOWA ACADEMY OF SCIENCE
AWARDS

DISTINGUISHED IOWA SCIENCE TEACHING

Jerry Honts, Drake University

DISTINGUISHED SERVICE

Iowa Children’s Water Festival

EXCELLENCE IN SCIENCE TEACHING

LIFE SCIENCE

Starla Pottorff, Corning Community High School, Corning

EARTH/ENVIRONMENTAL SCIENCE

Chris Robinson, Washington High School, Cedar Rapids

PHYSICAL SCIENCE

Nicole Scott, Iowa City High School, Iowa City

ELEMENTARY SCIENCE

Matt Robie, North Polk Central Elementary, Des Moines
# Section Programs/Special Sessions/Abstracts

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1. Integrated effect of tillage and nitrogen sources management on corn response

D. KWAW-MENSAH, M.M. AL-KAISI, and M.A. LICHT

Iowa State University, 2104 Agronomy Hall, Ames, IA 50011-1010

Tillage and nutrient management have significant impact on soil productivity. An integrated approach in nutrient and tillage management is thus essential to soil productivity. Three tillage systems (conventional, strip-tillage and no-till) and four N rates from manure and commercial fertilizer sources were used in this study. Initial soil samples of 0-5 feet increments depths for N, P, C, EC and pH analysis were taken prior to soil tillage and N-application. Late spring soil nitrate test (LSNT) and fall stalk nitrate test (FSNT) were determined for each N source experiment. Grain yield was determined by harvesting each N rate treatment. The major objective of the study is to investigate the effectiveness of tillage systems and N sources on N use efficiency by corn. Initial results of this study indicate a significant difference in yield between the optimum and low N-rates. LSNT and FSTN increase with increase of N rate from both N sources of manure and commercial fertilizer. Tillage systems show no significant differences in yield, LSNT or FSNT.

2. Nitrogen management effect on soil carbon dioxide emission

M.L. KRUSE, M.M. AL-KAISI, and J. SAWYER

Iowa State University, 2104 Agronomy Hall, Ames, IA 50011-1010

The increase in atmospheric carbon dioxide over the last century has led to an increased interest in soil carbon dynamics and soil carbon sequestration. The focus of this study is to investigate the carbon-nitrogen relationship based on CO2 emissions in relation to different nitrogen rates in high yield environments. The study consists of seven sites across Iowa, each consisting of 6 different N rates in four different replications. Data collection involves soil sampling at 0-5, 6-15, 16-30 and 31-60 cm increments to be analyzed for total soil carbon and total N. The soil samples are taken in a corn-soybean rotation. Carbon dioxide (CO2) emission was measured during the growing season under N rates of 0, 90, 180, and 225 kg N ha-1 on a weekly and bi-weekly basis. Preliminary results suggest that CO2 emission rates increase with the increase of N rate and total soil carbon and nitrogen tend to decrease with soil depth. Residue's total C and N input increased with the increase of N rate.

3. Comparative influence of various tillage systems on the soil vadose zone environment

M.A. LICHT and M.M. AL-KAISI

Iowa State University, 2104 Agronomy Hall, Ames, IA 50011-1010

The purpose of the study is to evaluate the effect of fall strip-tillage, spring strip-tillage, chisel
plow, and no-tillage and time of nitrogen application on soil and water quality and nitrogen use efficiency. Plant and soil samples were collected for several depth increments and analyzed for total carbon, nitrogen, phosphorus, and nitrate nitrogen. Soil temperature, compaction, moisture, emergence, and yield were recorded. Water samples were collected using a suction lysimeter at 1.2 m. Results from 2001 show soil nitrate and phosphorus levels at the top 15 cm soil depth were greater for no-tillage compared to other fall fertilizer treatments (fall strip-tillage and chisel plow). Plant nitrogen uptake for the chisel plow treatment was significantly different at the V6 and V12 growth stages compared to no-tillage and fall strip-tillage with fall fertilizer. Soil resistance at the 0-15 cm soil depth was least under the fall chisel plow system compared to other tillage treatments. Soil moisture depletion extended down to 120 cm in the soil profile at 10 weeks after planting for both chisel plow and strip-tillage systems, while maximum depletion occurred at the 60 cm soil depth for no-tillage. Water nitrate samples at the 120 cm depth showed significant differences between tillage treatments for the June 18 sampling period. Yield and emergence index showed no significant differences between the tillage systems, but spring strip-tillage had a slight advantage. Soil temperature was not significantly different for all tillage treatments.

ANTHROPOLOGY

Presiding: Colin Betts
Friday, April 25, 2003: 8:00 a.m. - 10:00 a.m. ~ Room 312

8:00 a.m. Bowen's Prairie: Archaeology of an Iowa pioneer community

C.L. PETERSON

General Contracts Program, Office of the State Archaeologist, The University of Iowa, Iowa City, IA, 52242

During 2001, six historic sites along the old Military Road in Jones County, Iowa were subjected to archaeological excavation in anticipation of highway construction that will impact these sites. Five of these sites were related to the 1838 to ca. 1900 community of Bowen’s Prairie (Iowa archaeological site numbers 13JN152, 13JN168, 13JN169, 13JN196, and 13JN203); the other was located near Langworthy (site 13JN190). These sites included a cheese factory, a post office, two churches, and several residences and their associated features.

Although these sites were located within upland-context agricultural fields that had been plowed for more than 100 years, feature preservation was outstanding: more than 250 features were identified. Artifact analysis and archival research are ongoing. Preliminary results have revealed new information about the lives of Jones County pioneers in the areas of diet, consumerism, settlement patterns, and early versus modern perceptions of community.
8:20 a.m.  History's highway: The old Military Road

A.R. COLLINS

General Contracts Program, Office of the State Archaeologist, The University of Iowa, Iowa City, IA, 52242

The construction of the Military Road in 1839 played an integral role in the early settlement of eastern Iowa. The road held steady stagecoach traffic and served as an emigrant route to the Iowa Territorial Capitol and its environs. Towns linked solely by the Military Road faded in importance as railroad construction diverted traffic. Bowen's Prairie, in Jones County, is an example of such a settlement: failure to obtain a railroad connection ultimately spelled the demise of the town.

The Dubuque to Monticello portion of the 1839 Military Road survey map was recreated by the Office of the State Archaeologist to aid in present and future archaeological/historic research. The map depicts natural and cultural landmarks, including cabins, fields, and intersections with "Indian" and "trading" trails. Also shown on the map is "Bowen's Settlement." The presence of the Settlement probably influenced the course of the road itself.

8:40 a.m.  Site 13JN196: Daily life at a 19th century homestead

C.L. NAGEL

In 2001, large-scale archaeological excavations were undertaken at an early farmstead site (13JN196), located south of Cascade along the old Military Road (US Highway 151) in Jones County. The remains of two foundations, two cisterns, a root cellar, a well, and several refuse pits yielded many artifacts dating from the late 1830s through the early 1900s. This site also includes a small prehistoric component. Preliminary archaeological and archival research at 13JN196 has revealed copious information on the lifestyles of the early site occupants, particularly regarding religion, diet, social activities, and consumerism.

9:00 a.m.  The Goodin-Tanner Site: Archaeology at an early Iowa farmstead

S.K. OSBORNE

Archaeologists from the Office of the State Archaeologist of Iowa conducted excavations at the Goodin-Tanner Site (site 13JN190) during the spring of 2001. This site is located south of Langworthy, along the Military Road. The remains of the residence, a root cellar, barn, well, possible septic field, and several other pit and refuse features were present below the plow zone. Archaeological and archival data indicate that the farmstead was settled in 1854 and was inhabited until fire destroyed the main residence in the late 1870s. This fire preserved foodstuffs and a wide variety of possessions beneath and within the charred rubble. This paper will explore how the synthesis of archaeological and archival data can provide a rich-
er picture of life at the Goodin-Tanner farmstead. Aspects such as diet, health, and personal tastes were revealed in the archaeological record. Available historical documents added religious, economic, and social layers to the story of these two families and their pioneer community.

9:20 a.m.  **Cheese: Wheels of change in Iowa agriculture**

**S.L. HANKEN**

General Contracts Program, Office of the State Archaeologist, The University of Iowa, Iowa City, IA, 52242

During the past 150 years, Iowa's early farm organization changed from subsistence to the global market economy of today. This paper seeks to show that early industrial development in the dairy business was a force for rapid and profound social change. By looking at available historical information in conjunction with the 2001 excavation of the Palmer Cheese Factory in Jones County (13JN168), it becomes apparent how the organization of the early cheese industry and resultant higher sanitation standards impacted farmers and community alike. The Palmer Cheese Factory, seemingly insignificant and unknown, was part of a larger movement that altered a way of life. Self-sufficient rural communities had always existed without the need for large amounts of capital by basing their livelihood on competency and mutual respect. The new, cash-driven economy, represented by the Palmer Cheese Factory, relied less on community and more on profit and invention. Thus, the change from home production to the manufacturing of cheese and butter in the factory system marked the beginning of the end for shared experience and old time cooperation in farming.

9:20 a.m.  **Human ethology: ethological methods and anthropology**

**V. BENTLEY-CONDIT, W. BRYCE, T. LEWIS, C. PRIOR, A. SCHORTMAN, M. WATSON, A. WOODS**

Grinnell College, Grinnell, IA 50112

This panel is the result of a new anthropology course offered this semester at Grinnell College. The goals of the course are to teach the methodology and encourage students to think about human behavior from an ethological perspective. The anthropologists' focus on humans and their behaviors unites the four fields while anthropologists' questions about human behavior vary widely. Ethologists focus upon animal behavior and "why" questions, utilizing Tinbergen's (1963) four levels of explanation (i.e. causation, ontogeny, evolution, function). Human ethology is an interdisciplinary approach to the study of human behavior that applies the ethologists' methodology to the anthropologists' interest in human social behavior. It tends to integrate observing human behavior under "natural" conditions with taking an evolutionary approach to understanding "why". In this panel, we explore the application of ethological methods in various anthropological studies. Each panel participant had conducted research for a project in which he/she incorporated observational data of humans' "natural" behavior. Each student's study addresses at least one of Tinbergen's levels of explanation. We will begin with a very brief overview of human ethology followed by each panel member presenting the highlights of her/his research and the pros and cons of this approach to an anthropological understanding of human behavior.

9:40 a.m.  **SECTION BUSINESS MEETING**
8:00 a.m.  The *Glycine max* floral nectary: a small but fascinating secretory organ

H.T. HORNER*, R.A. HEALY**, and R.G. PALMER†

*Department of Botany and Bessey Microscopy Facility, and **Departments of Agronomy and Zoology/Genetics and †USDA ARS CICGR, Iowa State University, Ames, IA 50011

The soybean floral nectary, as seen by light and scanning electron microscopy, is a small discoid mound that forms between the bases of the central hairy gynoecium and the stamen ring. The nectary exists for a very short time, forming just before flower opening and collapsing after flower opening. The nectary epidermis contains a large number of guard cells, most of which occur on its ridge and on the slope toward the gynoecium. After the nectary enlarges to its maximum size, the guard cells display either open or occluded pores. Initially, small beads of material are seen around some of the open pores, followed by an extrusion of these beads as chains over the nectary epidermis. The appearance of these beads coincides with the degeneration of cells inside the nectary, which signals the beginning of the collapse of the nectary. This process continues until the nectary is completely collapsed and results in a shriveled mound of cells with only the prominent guard cells remaining intact. The beads represent a non-water-soluble product of unknown composition. In addition, there are three types of trichomes on the gynoecium surface, one of which is secretory and appears active at the same time of nectary secretion. These observations suggest that the nectar consists of a variety of compounds, in addition to the typical soluble simple sugars.

8:20 a.m.  The *Glycine max* floral nectary: a fascinating secretory organ with unusual subcellular structures and manner of secretion

R.A. HEALY*, H.T. HORNER**, and R.G. PALMER†

*Department of Botany and Bessey Microscopy Facility, and **Departments of Agronomy and Zoology/Genetics and †USDA ARS CICGR, Iowa State University, Ames, IA 50011

The floral nectary is a short-lived discoid gland around the base of the gynoecium. It consists of an epidermis, with prominent guard cells, that covers a mound of special parenchyma innervated by fingers of phloem. When the nectary reaches its maximum size, special parenchyma around the phloem fingers degenerate first, followed by parenchyma further into the nectary, and finally the epidermal cells. All of these cells produce material in their vacuoles. The material consists of both a non-staining substrate and ribosome-like particles. As the vacuoles enlarge to near the periphery of the cells, several unique cytoplasmic structures appear: bundles of tubules pressed to the outside of the vacuole and in the cytoplasm away from vacuoles; single straight tubes containing ribosome-like particles in the cytoplasm and extending through plasmodesmata; and bridges of cytoplasm that extend into vacuoles like pockets. The functional significance of these structures is unknown. Following engorgement, vacuoles disintegrate and the cytoplasm and vacuole contents mix. This holocrine process terminates in collapse of cell walls and secretion of cellular contents. The entire nectary collapses leaving a shriveled mound and residue after the
flower has opened. This manner of secretion is different than that reported for all other legume floral nectaries studied so far, and may be significant in the potential to attract insects.

8:40 a.m.  **Environmental influences on phi thickening occurrence in gymnosperm roots**

**J.M. GERRATH**

Department of Biology, University of Northern Iowa, Cedar Falls, IA 50614-0421

Previous work in our lab had demonstrated that the occurrence of phi thickenings (lignified wall thickenings in the radial and tangential walls of the root cortex that resemble the letter F in cross section) are correlated with gymnosperm systematics, although their function is still unknown. The objective of this study was to test the hypothesis (borne of anecdotal evidence) that phi thickenings could be induced under environmental conditions favoring lignification; namely, a) water saturation, b) the presence of a fungal (mycorrhizal) association, and c) soil compaction.

Seedlings of *Cryptomeria japonica* (phi thickenings present), and *Pinus aristata* and *P. rigida* (phi thickenings absent under mesic conditions) were grown under conditions described above, and harvested after four months. Root/shoot lengths were measured, and anatomical sections were used to determine occurrence of mycorrhizal fungi and phi thickenings. Results showed that the treatments had highly significant effects on root morphology and root/shoot ratios, but that phi thickenings could not be induced in species in which they are not normally present. Although the function of phi thickenings is still not known, their occurrence has been shown to be a robust systematic character.

9:00 a.m.  **Distribution, habitat preferences and community impact of Alliaria petiolata (garlic mustard) in Iowa’s woodland plant communities**

**M. DORNBUSH, L. MOTTL, and T. ROSBURG**

Iowa State University, 353 Bessey Hall, Ames, IA 50011-1020

*Alliaria petiolata* (garlic mustard) is an exotic, herbaceous mustard, currently invading North American woodlands, that is believed to have a strong, negative impact upon the communities in which it establishes. However, little information is available on garlic mustard’s distribution in Iowa, its habitat preferences, its impact upon native woodland communities, or public awareness of this invader in Iowa. To determine garlic mustard’s distribution, as well as public perception of its potential impact, we mailed surveys to land management organizations statewide and examined herbaria records at Iowa colleges and universities. Study sites were then established in 18 different populations, and paired with adjacent non-invaded areas when possible, to determine habitat preferences and co-occurring plant community composition. Garlic mustard was found statewide, occurring in 37 Iowa counties, with greatest abundance in NE Iowa. Garlic mustard was found almost exclusively as a woodland understory species. However, few other generalizations were apparent, suggesting that garlic mustard can grow under a wide range of conditions. Species diversity in invaded areas was negatively related to garlic mustard cover. However, no significant change in species richness was evident, suggesting that decreased local plant diversity was largely the result of differences in community evenness between lightly and heavily invaded sites.
9:20 a.m.  **A floristic inventory of Bixby State Park and Preserve and the implications of a diverse preserve for conservation in Iowa**

**D.Q. LEWIS** and **W.R. NORRIS**

Department of Botany, 341A Bessey, Iowa State University, Ames, IA 50011-1020

The uniqueness of Bixby State Preserve has been recognized at least since early in the 20th century. A six-year floristic survey and previous reports of the flora of the preserve have resulted in a list of 456 vascular plant taxa (86% native) and 40 species of fungi. Seventeen of the vascular plants are listed as endangered, threatened, or special concern, including the federally listed *Aconitum noveboracense*. The presumed native, woodland grass *Cinna latifolia* is newly reported in Iowa. The richness of the flora of this small, 184-acre site is explained in part by the preserve's remarkable geology. The preserve is located on the Silurian Escarpment of the Paleozoic Plateau. The rugged landscape includes an ice cave, algific talus slopes, a spring, ravines and steep, wooded slopes of various aspects. Bear Creek bisects the park, and a thin-soiled opening on top of rocky bluffs supports a small prairie. Its historical protection as a nature sanctuary by the Bixby family and, since 1926, by the state has also contributed to its present diversity.

The contributions of Bixby State Preserve to conservation are significant, including roles that are process-, example-, species- and social values-oriented. However, acquisition of a buffer area and monitoring and control of aggressive exotic species are urgently needed to diminish encroachment and protect the biological integrity of the preserve.

9:40 a.m.  **Plant parasitic fungi of ten Iowa prairies**

**L.H. TIFFANY** and **G. KNAPHUS**

Iowa State University, Ames, IA 50011

Native prairie plants and introduced cultivated plants share a common hazard, diseases caused by plant parasitic fungi. Little attention has been given to fungal diseases of prairie plants and to their significance to the health, survival and reproductive success of native plants. At present, our prairie heritage consists of scattered, usually small, remnants. To successfully maintain the original mix of plants in these isolated prairies, we need information about all factors that influence the prairie plants.

Collections of plant disease fungi have been made since the mid 1980s to the present in the ten Iowa prairies considered here. These prairies include Five Ridge preserve, Runkel preserve and Waubonsie State Park in the western Iowa Loess Hills region; Steele preserve, Sheeder preserve, and Dinesen preserve also in western Iowa; Kalsow preserve, Anderson preserve, Doolittle preserve and Pohl preserve in central Iowa; Cedar Hills sand prairie preserve and Marietta Sand prairie preserve.

From the sand prairie preserves, 86 fungi have been collected on 59 host plants. From the central Iowa prairies, 169 fungi have been collected on 98 host plants. From the six western sites, 187 fungi have been collected on 124 hosts. Some fungi were present on their host plants at all prairies, others were present only at specific prairies and absent in others even though their host plants were present.
A comparison of growth and reproduction among native Iowa populations of *Panicum virgatum* (switchgrass) and two non-native cultivated varieties grown in common gardens

D.W. WILLIAMS, L.L. JACKSON, G.A. HOUSEAL, and D.D. SMITH

Native Roadside Vegetation Center- University of Northern Iowa, Cedar Falls, IA 50614-0294

Plant survival, growth and reproduction may be affected when grown away from their local source. The objective of this study is to determine if survivorship, growth, seed set and seed viability differences exist among local and non-local native populations grown in common gardens. We hypothesize that plants grown near their origin will have improved survivorship, growth and reproduction over those from distant origin.

Seed of *Panicum virgatum* was collected from four native remnant populations in northern and southern Iowa. In addition, *P. virgatum* seed from South Dakota and Nebraska of two cultivated varieties (Nebraska 28 and Sunburst) were used in the study. Plants were greenhouse grown and transplanted into common gardens established in northern and southern Iowa in May 2002. Sampling was conducted in August and September 2002. Percent of filled seed and percent germination will be analyzed.

Northern Iowa populations of *P. virgatum* had significantly (p<0.05) more tillers per plant over at least one cultivated variety in all three plots. Northern populations of *P. virgatum* had significantly (p<0.05) more culms per plant than both cultivated varieties in all the plots. Both northern and southern Iowa populations averaged more vegetative tillers and reproductive culms than the cultivated varieties. Preliminary results suggest that local populations are more fit than non-local populations. Results of seed fill and germination will be presented.

10:20 a.m.  SECTION BUSINESS MEETING

POSTERS

4. Natural selection on flower color in a California wildflower

R.M. BRUMMEL and V.M. ECKHART

Grinnell College, Department of Biology, Grinnell, IA 50112-1690

Understanding the maintenance of genetic polymorphism in natural populations is a central issue in ecology, evolutionary biology, and conservation biology. Flower color polymorphisms are especially valuable model systems, as they provide an accessible link between genotype and phenotype. The California wildflower, *Clarkia xantiana* A.Gray (Onagraceae), exhibits a balanced polymorphism in petal spotting. Past research indicates that pollinators (solitary bees) and herbivores contribute to selection on petal spotting in this species. This study investigates modes and causes of natural selection on petal spotting in *Clarkia xantiana* in order to characterize spatial and temporal variation in selection and identify specific herbivores that contribute to selection. We analyzed phenotypic selection on petal spotting and other selected traits in eight populations in summer, 2002. In most populations spotting was not under selection that year. In one population, however, we detected significant directional, stabilizing, and correlational selection on petal
spotting. We also found that grasshopper damage to fruit correlated negatively with spotting. Together, these findings suggest an advantage to individuals with intermediate levels of spotting, perhaps corresponding to heterozygote advantage in this single-locus trait. Stabilizing selection, in part, can be attributed to grasshopper avoidance of highly spotted phenotypes. This study highlights the importance of spatio-temporal variation and herbivory in the maintenance of flower color polymorphisms.

5. Comparative developmental anatomy of tendrils in some species of the grape family (Vitaceae)

S. SHEELEY, K. BOHL, and J.M. GERRATH

Department of Biology, University of Northern Iowa, Cedar Falls, IA 50614-0421

Tendrils, the leaf-opposed coiling organs present in the vines of the family Vitaceae, are thought to be modified stems. If this is true, the development of tendril vascular tissue should follow the same pattern as stem vascular tissue. To investigate this hypothesis, we observed tendrils from three species of Vitaceae, both intact and in cross section, at three stages of development.

For each of the three species, Parthenocissus tricuspidata, Rhoicissus digitata, and Vitis riparia, we sampled young, intermediate, and mature tendrils from a growing shoot. When the tendrils of the three species were observed intact, there were noticeable structural differences on the surface. *V. riparia* tendrils tended to become hard and woody as they developed, *P. tricuspidata* tendrils had adhesive disks at all stages, and *R. digitata* tendrils appeared to have a bud and bract about 1/3 of the way from their apex. Among the three species, the vascular tissue development was similar and appeared to mirror the development of a stem when viewed in cross section. The bract and bud on *R. digitata*, as well as the vascular tissue development indicate that tendrils in these three species of Vitaceae are formed by the modification of shoots.
tems have provided sufficient evidence of diversity among population samples. Chi-square analysis of the two brown trout strains showed highly significant differences in band frequencies for every allozyme system but one. Modified Shannon-Weiner diversity indices were calculated for each allozyme system and indicated larger diversity indices for the wild French Creek strain vs. the domestic brown trout strain. Higher diversity indices in the rainbow trout strain over the other domestic strains also were observed. Greater strain over the other domestic strains also were observed. Greater diversity in the wild vs. Domestic populations may suggest the importance of genetic variability for the reproductive survival of a species. With this information, additional studies may focus more on a molecular level to determine genomic similarities and differences between the two brown trout strains.

8:20 a.m.  **Genetic mapping in Gibberella zeae (Fusarium graminearum)**

**J. JURGENSON**

Department of Biology, University of Northern Iowa, CedarFalls, IA 50614

*Gibberella zeae* (anamorph *Fusarium graminearum*) is the most important causal agent of scab in the United States. Scab reduces wheat baking quality and harvested grain often is contaminated with mycotoxins. *G. zeae* is homothallic, produces abundant perithecia in the field and can be outcrossed in the laboratory. We have recently reported the construction of a genetic map of *G. zeae* by crossing nitrate non-utilizing (*nit*) mutants of *G. zeae* strains R-5470 (lineage 6 from Japan) and Z-3639 (lineage 7 from Kansas, USA). This genetic map is based on 1048 AFLP markers. This linkage map contains numerous loci with distorted segregation ratios and two possible chromosome rearrangements between the parental strains. In order to clarify the anomalies that exist in the genetic map we constructed a new linkage map between two lineage 7 strains (Z-3639 and PH-1 from Michigan, USA). We used a strain with a deletion in the *MAT2* gene as the female to avoid distortion associated with *nit* markers. Loci common to the two genetics maps will allow identification of the linkage groups and elucidation of the segregation distortion and putative chromosome rearrangements.

8:40 a.m.  **The function of the chitin ring in budding yeast**

**M. SCHMIDT, T. DRGON, B. BOWERS, A. VARMA, and E. CABIB**

Des Moines University - Osteopathic Medical Center, 3200 Grand Ave, Des Moines, IA 50312

The cell wall of yeast consists of sugars, proteins and amino sugars. Although the amino sugar chitin represents only about 3% of the total cell wall carbohydrates, it is essential for the fungus' survival. This is probably due to the function of chitin in cytokinesis. There are 3 chitin synthase activities (*CSI, CSII and CSIII*) in yeast, each one performing a different cellular function. At the start of the cell cycle, CSIII lays down a chitin ring in the cell wall. The new bud emerges then through the opening of this ring. CSIII also synthesizes chitin that is dispersed over the cell surface and serves to reinforce the cell wall. After cytokinesis, CSII forms a chitin septum that separates mother and daughter cell. The existence of a chitin ring at the bud neck has been known for 30 years, but since CSIII-deficient mutants have no serious growth defects, no important function for this structure has been suggested.

We isolated several mutants in which CSIII is essential for survival and were able to show that
the chitin ring provides support for the bud neck. In mutants with a defect in septum formation, CSIII is necessary for a salvage cytokinesis mechanism. However, we could show that this function does not require the chitin ring. In other CSIII requiring mutants, an intracellular protein scaffold at the bud neck is not assembled properly. Lacking the intracellular support, loss of the extracellular chitin ring leads to an expansion of the bud neck and cell death. The sole function of the chitin ring thus is to help maintain the bud neck constriction.

9:00 a.m.  

**Differential gene expression in the flagellated protozoan *Crithidia fasciculata***

R.P. AMES* and A. BRITTINGHAM

*Drake University, and Des Moines University, Des Moines, IA 50312

*Crithidia fasciculata* is a member of an early branching order of eukaryotes, and exists in two forms within the gut of its mosquito host. One is a non-motile form, attached in clusters to the lining of the insect gut; the other a more elongated form swimming freely in the gut lumen. These two distinct phenotypes have been characterized as nectomonad (motile) and haptomonad (non-motile) forms, and are easily observed in culture. Our studies were designed to identify and characterize genes/proteins that are differentially expressed during *Crithidia* growth and differentiation from haptomonad to nectomonad forms. Using two different cultivation methods, shaking and stationary incubations, we have demonstrated a growth phase regulated adherence phenotype. Organisms in logarithmic phase of growth possess the ability to adhere to substrates; this ability is lost when the organism enters a stationary growth phase. Current studies are focused on the identification of surface proteins, whose expression are differentially regulated during the transition from adherent to non-adherent forms. Results of these studies will not only provide information of the cellular and molecular biology of *Crithidia*, but also other closely related protozoan parasites (*Leishmania* and *Trypanosoma*), which cause diseases of man and animals.

9:20 a.m.  

**Exposure of lymphocytes to nitrite alters cell growth and cytokine production**

F. LU and L. BELTZ

Department of Biology, University of Northern Iowa, Cedar Falls, IA 50614

Nitrate is a common contaminant of well water and once ingested, bacteria in the gut oxidize nitrate to nitrite. Nitrite has been implicated in a number of human disease conditions, including methemoglobinemia, which decreases the oxygen-carrying capacity of the blood and is particularly severe in infants. In this study, we look at effects of nitrite on the functions of lymphocytes, white blood cells that are the cornerstone of the immune response.

Lymphocyte growth was measured by the MTT assay, an indicator of viable mitochondria. In this assay, mitochondria metabolize the yellow MTT salt into a purple formazan molecule which is read spectrophotometrically at 570 nm in a microplate reader. Nitrite, but not nitrate, decreased lymphocyte growth in a dose-dependent manner in concentrations as low as 1.4 ppm nitrate-N in almost all donors tested. The maximal contaminant level in the U.S. is 10 ppm. Decreased growth was seen after stimulation of either T or B lymphocytes. We also looked at the production of cytokines, immune messenger molecules. The production of the Th2 cytokine interleukin-10 was decreased in many donors while the regulatory Th3 cytokine transforming growth factor-beta was increased in some individuals and decreased in others.
Inhibition of hepatic cytochrome P-450 4A decreases arterial pressure in spontaneously hypertensive rats

A.P.J. OLSON, M.R. THOMPSON, and S.H. CARLSON

Luther College, 700 College Drive, Decorah, IA 52101

Hypertension has been shown to be a major risk factor for cardiovascular disease and stroke; however, its etiology is unknown. One factor that contributes to the regulation of blood pressure is 20-hydroxyeicosatetraenoic (20-HETE), a product of arachidonic acid metabolism by the cytochrome P-450 enzyme (the 4A isoform; P-450 4A). P-450 4A is overexpressed in kidneys of spontaneously hypertensive rats (SHR), correlating with an increase in renal 20-HETE levels and abnormal salt and water retention. Previous work in our laboratory has demonstrated that the liver also contributes to arterial pressure regulation. However, the role of hepatic P-450 4A expression in hypertension has not been studied. In the present study, hepatic P-450 4A levels from male Sprague-Dawley rats (SD) and SHR were quantified by western blot analysis. P-450 4A was significantly overexpressed (122%) in the livers of the SHR compared with normal SD rats. Furthermore, infusion of 1-aminobenzotriazole (ABT), a suicide inhibitor of P-450 4A, significantly decreased blood pressure in conscious SHR (-22 mmHg). These experiments suggest that hepatic cytochrome P-450 4A contributes to hypertension in SHR. We are further investigating the roles of hepatic cytochrome P-450 4A and 20-HETE in hypertension and salt sensitivity in SHR.

CHEMISTRY: INORGANIC AND ORGANIC

Presiding: Wanda Reiter and Gholam Mirafzal
Saturday, April 26, 2003: 8:00 a.m. - 10:00 a.m. ~ Room 316

The theory of simultaneous addition competitive binding immunoassays

W.S. REITER and D.S. HAGE

Iowa Wesleyan College, 601 North Main St., Mt. Pleasant, IA 52641
University of Nebraska-Lincoln, Lincoln, NE 68588

Competitive binding chromatographic immunoassays are based on the competition between a small amount of analyte and a fixed amount of labeled analyte (label) for a limited number of antibody binding sites in a column. Two types of competitive binding immunoassays that differ in the way that the analyte and the label are applied to the column include sequential and simultaneous injection assays. In a sequential addition assay, a small amount of analyte is applied to a column, followed by the addition of the labeled analyte. In contrast, a simultaneous addition assay is performed by applying the analyte and the label at the same time to the column.

Equations were developed that predict the behavior of simultaneous addition chromatographic immunoassays based on non-linear chromatographic theory. These equations predict assay response under a variety of conditions, including the amount of labeled analyte injected, the number of binding sites in the column, and the flow rate.
8:20 a.m. **Iron porphyrin-catalyzed olefination of carbonyl compounds with ethyl diazoacetate**

G.A. MIRAFZAL and M.J. HARRIS

Drake University, Department of Chemistry, 2507 University Ave., Des Moines, IA 50311

Iron(II) meso-tetraphenylporphyrin is an efficient catalyst for the selective olefination of a variety of aromatic and aliphatic aldehydes using ethyl diazoacetate in the presence of triphenylphosphine. These reactions gave olefin products in excellent yields (>85%) with high selectivity for the E-isomer (>90%). Iron(III) meso-tetraphenylporphyrin chloride, reduced in situ, could also be used as an olefination precatalyst to produce similar yields and selectivities.

8:40 a.m. **Analysis of the products produced during the monolayer oxidation of methyl linoleate**

A. TEKIN and E.G. HAMMOND

Iowa State University, Food Science and Human Nutrition, Ames, IA 50011

Methyl linoleate and oleate were deposited as a monolayers (20% by weight) on Silica Gel H and allowed to oxidize in air. Maximum peroxide values observed were about 2000, after which they declined slowly. The products were extracted, reduced with HI, and analyzed by gas chromatography and identified by El- and Cl-MS. Weight recovery of the methyl esters from silica gel was about 90%. Methyl oleate monolayers did not oxidize appreciably at 60°C, but methyl linoleate oxidized rapidly and followed first order kinetics. GC and GC/MS revealed that the identities and percentages of major groups were 13% methyl 9-oxononanoate, 20% methyl epoxyoctadecenoate, 25% methyl hydroxyoctadecadienoate and 22% methyl hydroxyoepoxyoctadecenoate. The epoxy, hydroxy, and hydroxyepoxy ester groups all contained four major peaks. The proportion of products measured by GC did not vary greatly with time, except that the hydroxyl group, which presumably represent reduced hydroperoxides, occurred in greater percentages in the early stages of oxidation and the hydroxylpoylpeaks appeared later than the others. The groups also could be separated by thin-layer chromatography. The rest of the products, about 20% included a variety of scission products in minor amounts.

9:00 a.m. **Modified high-oleic sunflower oil for cheese making**

D.R. IASSONOVA and E.G. HAMMOND

Iowa State University, 2312 Food Science Bldg., Ames, IA 50011

Milk fat (MF) contains short-chain fatty acids (SCFA), which contribute to the flavors to dairy products. We hypothesized that high-oleic sunflower oil (HOSO) into which SCFA and short-chain branched fatty acids (SCbFA) were interesterified would have an acceptable flavor and could be used as a substitute for MF in cheese making. The objective of our study is to test this hypothesis and make a cheese-like product from soy protein and modified HOSO.

Modified HOSO was synthesized by a sodium methoxide-catalyzed transesterification of HOSO and ethyl esters of SCFA, either alone or with ethyl esters of SCbFA. The reaction mixture was
washed with aqueous acetic acid and distilled at 185.5°C in a molecular still to remove short and long chain ethyl esters. A sample of the modified HOSO was converted to decyl esters and analyzed by gas chromatography for fatty acid composition. The SCFA composition of the modified HOSO was close to that of MF, but the interesterification seemed to discriminate against butyrate. To make the modified HOSO more like milk fat it was then interesterified with tributyrin and redistilled. The flavor of cheese made with modified HOSA was acceptable but considered inferior to that of cheese made with MF. The flavor of the modified HOSO cheese was made more like that made with MF by adding lactones and ketones that are characteristic of MF.

9:20 a.m.  SECTION BUSINESS MEETING

POSTER

6.  Analysis of the molecular components of the cement-like secretion of the marine polychaete worm, Phragmatopoma lapidosa

K.L. SUCKOW and M.A. DEAN

Coe College, 1220 First Avenue, NE, Cedar Rapids, IA 52402

Phragmatopoma lapidosa, marine polychaete worms, live in tubes constructed of cemented grains of sand. This species forms colonies and reefs of amassed sand tubes along the southeast coast of Florida. We have investigated the composition of the cement of the reef-building worms.

A set of analytical tests was used to indicate the presence of protein, inorganic, and lipid-soluble components within the cement structure. Extraction solutions including 1M Tris, 1% SDS, 8M urea and 1% EDTA were used to isolate cement components. The molecular weights of a few protein components were determined through denaturing polyacrylamide gel electrophoresis and silver staining. Electron dispersive spectroscopy was used to identify inorganic components.

CONSERVATION

Presiding: Paul Christiansen
Saturday, April 26, 2003: 8:00 a.m. - 10:20 a.m. ~ Room 310

8:00 a.m.  Response of a red cedar (Juniperus virginiana) dominated sand prairie to chip-in-place clearing

P. CHRISTIANSEN

Department of Biology, Cornell College, 600 First Street W. Mount Vernon, IA 52314

A grove of red cedar (Juniperus virginiana) that had invaded a sand prairie prior to 1970 in Big Sand Mound Nature Preserve, Muscatine, Iowa, was chipped in place in 1995. Two transects to measure response of vegetative cover were set out in 1997 in formerly 90+% red cedar cover. In addition, two previously existing transects having pretreatment cover of red cedar of 55% were
measured in 1998. In 2002 all four transects were remeasured. Cover of chips on the newer transects at 61% in 1997 was down to 2% in 2002. Prairie grass cover remained at about 48% on the two older transects but increased from 29% to 42% on the newer transects. Fragrant sumac (Rhus aromatica), a sand prairie shrub, went from 20% to 32% cover while non-prairie woody cover averaged less than 5% cover in 2002. An indication of prairie maturity, on the newer transects, was a decrease early successional species such as red sorrel (Rumex acetosella), an exotic weed, from 14% to 1% cover and fall witchgrass (Leptoloma cognatum), a native of sand prairies, from 8% to 3% cover. Overall, the chip-in-place treatment appears to have been successful in increasing prairie cover and decreasing invading woody cover.

8:20 a.m.  Use of external measurements to determine sex of American crows, (Corvus brachyrhynchos)

R. LAMPE, T. HARGENS, and C. OVERGAARD

Buena Vista University, Storm Lake, IA 50588

In an ongoing study of winter roosting behavior in American crows, eleven external measurements were recorded from a collection of 82 crows shot in Storm Lake, Iowa, during the winter months of 2002. Internal examination of gonads was used to determine gender. Greatest length of head and body weight were significantly different between adult male and female crows.

8:40 a.m.  Anuran diversity and relative abundance in eastcentral Iowa, 1993-2000

K.J. MCKAY, S.B. HAGER, and C.R. MCKINNEY

Niabi Biological Research and Monitoring Center, 420 1st Ave., P.O. Box 452, Hampton, IL 61256

Since 1993, we have conducted three frog and toad breeding chorus survey routes in eastcentral Iowa (Clinton and Scott Counties). We used this data to assess anuran richness and relative abundance from 1993-2000. Fifteen sites, among three routes, were sampled once each during the early (late April), middle (early June), and late (early July) portions of the anuran breeding season. At each point, species were assigned a relative abundance code ranging from 1 to 3. Ten anuran species were recorded consistently throughout the study period, except in 1998 when only eight out of ten were heard calling. The relative abundance of four species was not significantly different across the eight years. These species included the Bullfrog (Rana catesbeiana), Northern Leopard Frog (Rana pipiens), Western Chorus Frog (Pseudacris triseriata), and Spring Peeper (Pseudacris crucifer). We did detect significant increases in the abundance of six species including the Cricket Frog (Acris crepitans), American Toad (Bufo americanus), Eastern Gray Treefrog (Hyla versicolor), Cope's Gray Treefrog (Hyla chrysoscelis), Green Frog (Rana clamitans), and Pickerel Frog (Rana palustris). However, the relative abundance of P. crucifer and R. palustris was lower than the abundance recorded for other anurans. We speculate that the timing of the surveys precluded an analysis of the early calling period of P. crucifer, whereas R. palustris is generally uncommon due to habitat deterioration and loss.
9:00 a.m.  **Sylvan Runkel: citizen of the natural world**

L.A. STONE and J. STRAVERS

23312 295th St., Elkader, IA 52043; Box 309, McGregor, IA 52157

Because of Sylvan Runkel, two generations of Iowa naturalists appreciate bird droppings, blood-roots, prickly ash, and wood ticks. Sylvan taught that every living thing is a “natural citizen” of the environment.

Sylvan’s grandmother gathered medicinal plants near her log cabin. As a boy, Sylvan explored the undammed Mississippi River. He hitchhiked across the United States in the 1920s. He saw the Wright Brothers and Charles Lindbergh fly their airplanes, and became a pilot.

Sylvan earned an Iowa State College forestry degree in 1930, became Iowa’s first Civilian Conservation Corps (CCC) camp director in 1933, then began a career with the U. S. Soil Conservation Service (SCS). Sylvan volunteered for World War II, but was injured in a glider crash on D-Day, June 6, 1944. The injury left him with a stiff left leg.

Sylvan worked as an SCS biologist until 1972. He also led countless nature hikes and outdoor education workshops. He was a candidate for president of the Iowa Academy of Science, and received numerous awards from conservation groups. He died in 1995 at age 88.

The authors spent six years writing the biography, *Sylvan Runkel: Citizen of the Natural World*. The talk will include slides and anecdotes about Sylvan’s life and career.

10:00 a.m.  **SECTION BUSINESS MEETING**

**POSTERS**

7. **Preliminary assessment of avian richness and relative abundance at Green Wing Environmental Laboratory, Amboy, Illinois**

K.J. MCKAY and S.B. HAGER

Niabi Biological Research and Monitoring Center, 420 1st Ave., P.O. Box 452, Hampton, IL 61256

A preliminary assessment of avian richness and relative abundance was conducted at the Green Wing Environmental Laboratory in northcentral Illinois, throughout all seasons, from early fall of 2001 through the breeding season of 2002. We conducted a total of six point count survey routes, three random area search waterfowl surveys, and two random area search nocturnal bird surveys. Additionally, we also recorded all birds identified between points (i.e. interpoint data). Overall, a cumulative total of 140 species were identified. This included 62 species of North American Migrants (NAM), 59 Neotropical Migrants (NTM), and 19 species of Permanent Residents (RES). A total of 4,440 birds were recorded during the entire project. Fall migration yielded 88 species (36 NAM, 37 NTM, 15 RES) and 1,954 individuals. During the winter season, 27 species were identified (13 NAM, 14 RES) including 332 individuals. We recorded 115 species during spring migration (52 NAM, 48 NTM, 15 RES) and tallied 1,572 individuals. During the breeding season, we encountered 55 species (20 NAM, 23 NTM, 12 RES) and recorded 582 individuals. Our sampling effort during this project was relatively small, nevertheless a large diversity of avian species
was recorded. This tends to suggest that the Green Wing Environmental Laboratory may be functioning as a "habitat island" within a Midwestern landscape matrix dominated by agricultural row crops.

8. Using herbarium records to document plant invasions in Iowa

S.E. ALWARD and V.M. ECKHART

Grinnell College, Department of Biology, Grinnell, IA 50112-1690

Understanding the invasion dynamics of exotic plants can contribute to both conservation biology and basic ecology. Herbarium records represent a database that can be tapped to trace the spread of plant species in space and time. Because the sampling of a flora in herbaria is not necessarily free of collection biases (in time, in space and in taxon), records of widespread native species might serve as suitable "controls" for comparison. This study uses records from herbaria at Grinnell College, the University of Iowa, and Iowa State University in an attempt to reconstruct the invasion dynamics of several exotic plant species in Iowa (e.g., Melilotus alba, M. officinalis, Daucus carota). Selected widespread, but not necessarily common, native species were used for comparison (e.g., Amorpha canescens, Lespedeza capitata, Eryngium yuccifolium). Long-established exotics have S-shaped cumulative distributions of county records that are very similar to those of widespread natives. Particular decades in which especially large numbers of specimens were deposited in herbaria (e.g., the 1950s) strongly influence the shapes of these distributions for both natives and exotics. The similarity of collection records between long-established exotics and natives suggest that some exotics spread very quickly throughout the state. The above analysis will be presented along with additional data on recently established exotics and temporal changes in geographic range.

9. The influence of hydrologic alterations on Rio Grande cottonwood forests in central New Mexico: a tree-ring analysis

N.C. CEPERLEY and P.J. JACOBSON

Grinnell College, Department of Biology, Grinnell, IA 50112-1690

Dams and diversions have altered the Rio Grande's hydrology over the past 50 years, disconnecting much of the river's cottonwood-dominated riparian forest from the annual flood pulse. We compared radial growth of Populus deltoides ssp. wislizenii at two sites, one connected and one disconnected from the annual flood pulse, in the Bosque del Apache National Wildlife Refuge. Our objective was to assess long-term effects of hydrological alterations on Rio Grande cottonwood forest. Standardized site chronologies of mean annual growth rate displayed significant interannual variation, although they did not consistently correlate with hydro-climatic variables. Nonetheless, low growth rates at both sites indicate that hydrologic alterations are reducing productivity, although the mechanisms may differ. Declining production in the disconnected site is attributable to water deficiency due to a lowered groundwater table combined with a lack of surface flooding and is reflected in high levels of canopy dieback. Declines in the connected site are attributable to soil anoxia associated with hydrologically induced alterations of soil structure and moisture dynamics. River restoration efforts must thus consider the multiple effects of hydrologic alterations on riparian forests connected and disconnected from the flood pulse.
10. Soil moisture is the principal regulator of belowground decomposition in the northern Chihuahuan Desert, New Mexico

M. LUNDBREDEN, P. JACOBSON, and K. JACOBSON.

Grinnell College, Department of Biology, Grinnell, IA 50112-1690

The extent to which water availability regulates decomposition in desert ecosystems is a much-debated issue. Some of the uncertainty may be due to the time scale over which decomposition has traditionally been measured. We conducted a 2-year field study of decomposition patterns to determine the effect of rainfall on rates of subsurface decomposition as measured by the cellulose cotton strip technique in the northern Chihuahuan Desert (New Mexico, U.S.A.). Four sets of cotton cloth strips were buried at depths of 10 cm over the course of the study and removed at varying intervals over approximately 6-month periods. Precipitation and soil moisture data were collected on site by an automated weather station. In all four treatments, there was a positive relationship between significant rain events, soil moisture, and rates of subsurface decomposition. Although this precipitation-dependent rate change was observed throughout the year, rates declined in association with decreasing temperatures during winter. Overall, these results suggest that rainfall and synchronized increases in soil moisture regulate cellulose decomposition rates in the Chihuahuan Desert.

ENGINEERING

Presiding: Tom Wheelock and Bion Pierson
Friday, April 25, 2003: 2:15 p.m. - 5:20 p.m. ~ Wedgwood Room

2:15 p.m. Bridge alternatives for Iowa county roads

F.W. KLAIBER and T.J. WIPF

Iowa State University, Ames, IA 50011

Approximately 80% of Iowa's 25,000 bridges are on secondary roads, and thus, are the responsibility of the 99 counties. The number of bridges in Iowa ranks it 5th in the nation while Iowa's population ranks 30th. Therefore, the state's tax base is limited, and Iowa county engineers have very limited funds to address their bridge problems. Research (past and current) sponsored by the Highway Research Board of the Iowa Department of Transportation has investigated several replacement alternatives that can be constructed by county crews.

This presentation will present three alternatives that have been tested in the laboratory as well as in the field in demonstration bridges. For clarity, in the following paragraphs these replacement systems will be referred to as Alternative 1, 2 and 3.

Alternative 1: Precast Double-Tee Units
In this system, steel-beam precast units which consist of new or used steel beams connected by a thin reinforced concrete slab, are fabricated in the off-season. The prefabricated units are then transported to the bridge site when several of the units are placed side-by-side. After connecting the units, a cast-in-place reinforced concrete deck is cast over the units to complete the super-
Alternative 2: Railroad Flatcars

This system utilizes decommissioned railroad flat cars (RRFCs) for the superstructures in low volume road bridges. The number of RRFCs used is obviously a function of the desired bridge width. By properly designing a connection between the adjacent cars, traffic loads can be distributed laterally in the system.

Alternative 3: Modified Beam-in-Slab Bridge

Modified Beam-in-Slab Bridges consist of steel beams spaced a designed distance apart, with a composite concrete fill in between them. By using arch shaped formwork between the beams, the amount of concrete on the tension side of the system can be reduced thus making it possible to use the system in long spans.

Based on laboratory studies and field tests, all three of these bridge systems have been shown to be viable, economical alternatives for low volume road applications.

2:35 p.m.  Non-contact Inspection of composites using air-coupled ultrasound

V. KOMMAREDDY, J. PETERS, and D. HSU

Center for Nondestructive Evaluation, Iowa State University, Ames, IA 50011

Conventional ultrasonic tests are conducted using water as a transmitting medium. Water-coupled ultrasound cannot be applied to certain water-sensitive or porous materials and is more difficult to use in the field. In contrast, air-coupled ultrasound is non-contact and has clear advantages over water-coupled testing. The technology of air-coupled ultrasound has matured over the years and some systems have become commercially available. This presentation reports our experience of applying air-coupled ultrasound to the inspection of flaws, damage and normal internal structures of composite parts. Through transmission C-scans at 400 kHz using a focused receiver, the resolution was sufficient to image honeycomb cells in the sandwich core. C-scans at 120 kHz with transmitter and receiver on the same side of a laminate, Lamb waves were generated and used for the imaging disbands between the skin and the honeycomb core of the composite. Air-coupled scan results will be presented for flaw detection and damage imaging in aircraft composite structures; in addition to the results, a De-convolution algorithm based on Maximum Entropy will be discussed for distortion in the lamb wave scan.

2:50 p.m. Assessment of reliability and availability of mechanical components at nuclear power plant

R. MARATHE and C. HEISING

Industrial and Manufacturing Systems Engineering, Iowa State University, Ames, IA, 50011

Study of aging of systems, structures and components (SSCs) is important for the evaluation of the reliability and availability of the SSC at any nuclear power plant. Life Cycle Management (LCM) principles developed by the Electric Power Research Institute (EPRI) were used at the Ft. Calhoun station to analyze various corrosion mechanisms. Failure modes of Chemical and
Volume Control (CVC) system were studied and failure rates calculated.

It was found that effective way to reduce corrosion is to develop monitoring systems for early detection of corrosion. It was observed that the charging pumps of the CVC system had the maximum failure rate, with failure of pump packing as the main cause. The availability rate for a charging pump was found out to be 68%. To remedy the failure related to pump packing, new packing material was suggested and tested in the plant. It was observed that the maximum time for packing replacement for old UTEX packing was 947 hours of pump operation. And after using the new GARLOCK packing, this increased to a maximum of 3127 hours of pump operation.

3:05 p.m.  Micro/nanoscale tribological characterization of nanoparticulate silicon carbide coatings

S. CHANDRASEKARAN and S. SUNDARARAJAN

Mechanical Engineering, Iowa State University, Ames, IA 50011

Silicon carbide (SiC) possesses low friction characteristics, good wear resistance, and high toughness and is biocompatible making it an excellent material for protective coatings in mechanical, high temperature, biological applications and more recently in microelectromechanical systems (MEMS) applications.

In this study, an atomic force microscope (AFM) is used to investigate micro/nanoscale friction and scratch/wear resistance of atmospheric-pressure chemical vapor deposited (APCVD) SiC coatings (1 mm thick) which have been modified into nanoparticulate coatings (~100 nm thick) using a femto-second laser. A comparison between the scratch-wear and friction tests performed on silicon carbide film and the nanoparticulate coating is expected to show improved nanotribological performance of the nanoparticulate coating. Surface structure and adhesion properties are also measured to aid discussion of micro/nanowear mechanisms and the effect of nanoparticulated structure on tribological performance.

If the nanoparticulated coatings exhibit significantly superior friction/wear performance, they form a new, effective and simple low cost option for micro/nanodevice applications requiring thin protective coatings.

3:20 p.m. Instrumentation and design considerations for a new electrostatic powder combustion testing method

N.J. GREENE, D.M. SHOEMAKER, H. XU, and G.M. COLVER

Mechanical Engineering, Iowa State University, Ames, IA 50011

The Electric Particulate Suspension (EPS) is a combustion ignition system being developed at Iowa State University for evaluating quenching effects of powders in microgravity (quenching distance, ignition energy, flammability limits). The EPS method has potential for ‘benchmark’ design of quenching flames that would provide NASA and the scientific community with a new fire safety standard. The EPS method also supports combustion modeling by providing accurate measurement of flame-quenching distance as an important parameter in laminar flame theory since it is closely related to characteristic flame thickness and flame structure. In microgravity, the EPS
method is expected to produce dust suspensions that are highly uniform (prior to ignition) compared to 1-g where gravity causes dust cloud stratification.

The presentation gives an overview of work carried out to date including considerations in construction and design of the EPS combustion ignition system. Mechatronic and electronic controls utilizing data acquisition (LabVIEW) will be explained. Particle size distribution and 1-g particle stratification measurements are outlined. Additionally, an EPS system designed to calibrate an alternative dust suspension system at McGill University in Canada will be displayed.

3:35 p.m.    BREAK

3:45 p.m.    The wonderful cellulase zoo

P.J. REILLY

Chemical Engineering, Iowa State University, Ames, IA 50011

This presentation is a description of the many enzymes that symbiot-ically break down cellulose, which if successfully harnessed in an industrial process would give us a very expanded supply of glucose for fermentation into useful products. Three different cellulase types, endoglucanases, exoglucanases, and β-glucosidases, do this, the first by cleaving glyco-sidic bonds more or less randomly throughout the cellulase chain to produce cellobiose, the second by cleaving disaccharide units (cellobiose) from either end of the chain, and the third by cleaving cellobiose into its two constituent glucose molecules. Although it may be thought that all organisms would produce similar versions of the three cellulase types, this is not so. Instead there are nine different families of endoglucanases, two of exoglucanases, and two of β-glucosidases. These families differ not only in amino acid sequence, but also in their arrangement of helices, strands, and loops, and finally in their overall three-dimensional structures. This leads to very different enzyme properties.

4:05 p.m.    A novel breast cancer simulator to improve training of physicians’ tactile sensitivity and discrimination skills in clinical breast examination

G.J. GERLING, G.W. THOMAS, A.M. WEISSMAN, and E.L. DOVE

Departments of Mechanical and Industrial Engineering and Family Medicine, University of Iowa, Iowa City, IA 52242

Clinical breast examinations (CBE) are an important component in breast cancer screening. However, self-reports of confidence in CBE skills indicate that physicians receive inadequate training in tactile search of breast tissue to detect small (< 2 cm), hard tumors. Reported CBE sensitivity is only 39-59%, which is low and quite variable for a screening test, in part because tactile skills are difficult to train. To increase tumor detection sensitivity, we designed and tested a breast simulator with 15 dynamically controllable tumors. Water inflates handmade balloons embedded in formed silicone to simulate tumors of controllable hardness. The advantage, compared to traditional models which typically include five, static tumors, is that training scenarios can be reconfigured and repeated until each trainee learns the subtle tactile cues associated with tumors. Tactile discrimination feedback, provided through tumor inflation and deflation beneath the fingertips, helps teach discrimination between tumor and no-tumor conditions. The electron-
ic control system can also sense and record pressure exerted by examinees on each tumor. In a study of 48 medical students, training with the dynamic simulator increased the number of tumors found (F(42)=7.85, p=0.008), reduced the number of false positives (F(42)=5.20, p=0.028), and improved transfer of training (F(42)=22.29, p<0.001). Findings support the refinement of training to improve CBE sensitivity and specificity beyond current levels.

4:20 p.m.  **Electronic properties of the delafossite compound CuGaO₂**

**R.B. GALL and D.P. CANN**

Materials Science and Engineering, Iowa State University, Ames, IA 50011

Recently Cu-based transparent conducting delafossite compounds have been found to exhibit p-type conductivity either intrinsically or through various doping schemes. The development of a single oxide compound which can be effectively doped both n- and p-type would make a number of interesting transparent devices a reality. In this work, bipolar doping schemes were investigated for polycrystalline CuGaO₂ ceramics through aliovalent cation substitutions on the B-site. Dense, single-phase polycrystalline ceramics were synthesized by solid state reaction through controlling the oxygen partial pressure and quenching to room temperature. The high temperature phase equilibria as a function of oxygen partial pressure was examined through x-ray powder diffraction. These results were compared with thermodynamic calculations of the stability of phases in the Cu-Ga-O system. Electrical measurements were then performed in order verify the carrier type, carrier concentration, and conductivity.

4:30 p.m.  **Synthesis and electrical properties of CulnGaO₄ and Culn₂Ga₂O₇ ceramics**

**C. TAYLOR*, J. PENLEY, R. MARTIN, and D.P. CANN**

Materials Science and Engineering, Iowa State University, Ames, IA 50011

*Waukee Middle School, Waukee, IA 50263

The CuO-In₂O₃-Ga₂O₃ ternary phase diagram obtained by Kimizuka and Takayama reveals two ternary compounds, CulnGaO₄ and Culn₂Ga₂O₇. Both phases crystallize in the same structural family within the (YbFeO₃)nFeO structure where n=1 for CulnGaO₄ and n=2 for Culn₂Ga₂O₇. The In cation occupies the Yb sites, whereas the Cu and Ga cations occupy both Fe sites. Both compounds have a hexagonal unit cell with the In cation in a trigonally compressed octahedral coordination. The Cu and Ga sites are in five-fold coordination to oxygen via a trigonal bipyramid configuration. In this work, single-phase CulnGaO₄ and Culn₂Ga₂O₇ compounds were synthesized via solid state reaction. Powders of CuO, In₂O₃, and Ga₂O₃ were calcined in air at temperatures ranging from 900 to 1200°C. Bulk samples were prepared via sintering in air at temperatures up to 1200°C. The electrical properties were characterized by various techniques including conductivity versus temperature, impedance spectroscopy, and Seebeck effect measurements.
Effects of oxygen partial pressure on the dielectric properties of CaCu₃Ti₄O₁₂

S. AYGUN and D.P. CANN

Materials Science and Engineering, Iowa State University, Ames, IA 50011

Subramanian et al. discovered a permittivity greater than $e_r \sim 10^5$ (at 1 kHz) in polycrystalline CaCu₃Ti₄O₁₂. This result has been confirmed by others in polycrystalline, single crystal, and epitaxial thin films. This is an unusually large permittivity given the fact that there has been no evidence of ferroelectricity. The crystal structure of CaCu₃Ti₄O₁₂ can be described as pseudo-perovskite with a cubic unit cell with a lattice constant of 7.391 Å. The room temperature permittivity of CaCu₃Ti₄O₁₂ is nearly temperature independent. At low temperatures (~ 100 K) the dielectric spectra exhibits a relaxation where the permittivity drops to approximately 100. In this work, CaCu₃Ti₄O₁₂ ceramics were processed via solid state reaction at temperatures between 1000 and 1100 °C. Dense discs were obtained by sintering in a controlled atmosphere furnace at temperatures up to 1100°C in varying oxygen partial pressures. The dielectric properties were measured as a function of temperature and frequency. Room temperature permittivities close to 9000 were obtained at 100 kHz which is comparable to the values recorded in the literature. In addition, complex plane impedance analysis was conducted at room temperature over the frequency range 100 Hz to 10 MHz. The effects of oxygen partial pressure during sintering were related to the dielectric properties and the quantitative equivalent circuit obtained from the impedance data.

Synthesis and magnetic properties of Co-doped rutile and anatase ceramics

M.A. MARQUARDT, N. ASHMORE, and D.P. CANN

Materials Science and Engineering, Iowa State University, Ames, IA 50011

Thin films and sol-gel derived powders of both rutile and anatase TiO₂ doped with cobalt have been found to be magnetic at room temperature. In this study, polycrystalline rutile and anatase TiO₂ ceramics doped with 5 mol% Co were synthesized via solid state reaction in a controlled atmosphere furnace. Various processing techniques were employed to ensure a homogeneous distribution of the Co dopant, as well as achieve the desired crystal structure.

Sintered samples were characterized to determine structural, magnetic, and electronic properties. X-ray diffraction (XRD) combined with scanning electron microscopy (SEM) was used to determine the Co solubility within the TiO₂ host lattice. Magnetic properties were characterized using a vibrating sample magnetometer (VSM) and superconducting quantum interface device (SQUID) magnetometer. Lastly, conductivity was measured as a function of temperature.

While none of the samples were magnetic at room temperature, valuable information was gained on the structural properties of these ceramics.

SECTION BUSINESS MEETING
8:00 a.m.  Sequestration of phosphorus with iron mine tailings

E.J. BROWN, S. LIEGOIS, and M. CLAYTON

University of Northern Iowa, Cedar Falls, IA 50614

Surface water quality is currently one of the most important environmental issues facing the state of Iowa since the ecological and recreational health of water bodies are threatened by non-point source (NPS) pollution. Many lakes are polluted because of their high concentration of nutrients, often phosphorus (P), which leads to excessive algal growth (eutrophication). To prevent eutrophication, it is necessary to prevent P from entering surface waters or to sequester (make unavailable to algae) the P that is already in the water body. Ferric (Fe3+) and ferrous (Fe2+) iron are known to react with phosphate, leading to precipitates that tie up P. We found that the ferric iron primarily present in hematite can react with P. Our results suggest that the iron in hematite can be reduced to ferrous iron in anaerobic waters through anaerobic respiration by certain microorganisms present in Silver Lake, Iowa sediments. This ferrous iron either reacts with P directly or can be re-oxidized chemically or biologically back to ferric iron which forms P-sequestering particulate hydrous ferric oxides (HFO). Anaerobic re-oxidation of iron is facilitated by oxidants with a more positive redox potential than the ferric/ferrous couple such as the nitrate/N2 couple. If this occurs, iron oxidation also helps resolve nitrate stimulated eutrophication. The results indicate that oxidized iron compounds may be useful for pollution prevention and should also be considered for use in remediation of eutrophic lakes in Iowa and other locations where P is the major pollutant.

8:20 a.m.  Distribution of soil runoff phosphorus of the Cedar River watershed in Iowa

C.L. FIELDS and M.Z. IQBAL

Environmental Programs- University of Northern Iowa, Cedar Falls, IA 50614-0421

Surface water eutrophication and nutrient fertilization is currently one of the most important environmental factors facing the state of Iowa’s rivers and lakes. The agriculturally predominant Cedar River watershed has been estimated to contribute as much as 1/5 of the total nutrients into the Gulf of Mexico. Phosphorus is a significant contributing factor for eutrophication, as it is needed for biological processes and is used as a fertilizer on agricultural land. In this study, both bottom sediment and filtered water samples were taken weekly from 6 major tributaries of the Cedar River to determine both temporal and spatial distribution of phosphorus. These samples were taken from the same location positioned at USGS water discharge meters. Average total phosphorus concentrations for bottom sediments for the five-month study ranged from a low of 109.63µg/g at Beaver Creek in New Hartford, IA, to 350µg/g at Black Hawk Creek in Hudson. Conversely, Beaver Creek had the highest average total dissolved phosphorus concentrations at 147.56µg/L. Total phosphorus varied greatly during the sampling period, with the highest concentrations during the spring and late summer months for both dissolved and sediment samples. Beaver Creek at New Hartford sediment P had a range from 5.63µg/g in early August to 483µg/g in late August, during the same time period, total dissolved P increased from 81.92µg/L to
138.8 µg/L. A comparable increase was noted in all six of the sampling sites, correlating with a major flood event that occurred during the same time. The same relationship can be found in a major late June flooding.

8:40 a.m. **Tracing the Source of Fecal Bacteria into Silver Lake**

E.H. O'BRIEN and E.J. BROWN

University of Northern Iowa, Cedar Falls, IA 50614-0421

Surface water quality is currently one of the most important environmental issues facing the state of Iowa since the ecological and recreational health of water bodies are threatened by non-point source (NPS) pollution. Identification of host sources of bacteria entering surface water, along with their survival in water is important to formulation of remediation plans. In this study, the sources of fecal pollution in Silver Lake, Delaware County, Iowa were determined. Silver Lake is part of a small 221-acre watershed, with a primary land use of agriculture. The watershed is in direct contact with various varieties of livestock, waterfowl, and individual septic systems. Lake water and fecal samples were collected biweekly starting 6/02 and ending in 9/02, and analyzed for fecal coliform bacteria. Fecal coliform levels in the lake at the beginning of the summer were above the EPA Class A water guideline of 200 CFU/100 ml for fecal coliforms. As the summer progressed, the mean levels fell below this limit, but again rose at the end of the summer. Of the 780 fecal coliforms isolated, 93% were positively characterized as *Escherichia coli* and used in Multiple Antibiotic Resistance (MAR) analysis. Differences in the antibiotic resistance patterns among isolates were seen both spatially and temporally. Just as the bacterial levels dropped and rose in conjunction with geese and livestock populations around the lake, there was also a shift in the predominant antibiotic resistance patterns in July and August 2002.

9:00 a.m. **The effect of pesticide combinations on human cells**

Y. DENG and K.R. DHANWADA

University of Northern Iowa, Cedar Falls, IA 50614-0421

Pesticides are widely used in Iowa as a result of its agricultural economy. Many of the water sources in Iowa have been found to be contaminated by multiple pesticides. However, most of the information about adverse human health effects from environmental contaminants comes primarily from studies focusing on exposure to a single pesticide. Additionally, many regulations regarding levels of pesticide contamination refer only to single, individual pesticides. Much is not known about the effect of pesticide combinations on cells. Our study attempts to understand the effects of pesticide combinations on human cells. Normal human fibroblast cells, Detroit 551, were used in MTT assays (a type of cell proliferation assay) to test for the toxicity of several of the most heavily used pesticides in the US (atrazine, metolachlor, diazinon) either alone or in combinations. Results showed that there were statistically significant changes in cell proliferation even at very low pesticide exposure levels and the toxicity was increased in the presence of combinations. To determine if exposure of the pesticides on human cells resulted in cell cycle alterations, we did Western blot analysis to determine levels of cell cycle proteins, p53 and p21. Results demonstrated that the levels of these proteins were altered in the presence of pesticide.

9:20 a.m. **SECTION BUSINESS MEETING**
POSTERS

11. Lateral and vertical distribution of phosphorus in a Northeast Iowa wetland system

M.D. BOYCE, H.J. BAILEY, M.Z. IQBAL, and E.J. BROWN
Earth Science, University of Northern Iowa, Cedar Falls, IA 50614

This study was conducted north of Cedar Falls, Iowa. The purpose of this study was to determine the Phosphorus (P) inflow from the surrounding land. This Northeast Iowa wetland system contains homogenized P concentrations in the top 15 cm of sediment. West Lake's top 15 cm sediment average is 500µg/g while Railroad Lake's average is 691µg/g. The cause of P homogeneity in this range is most likely due to the suspension and mixing of fine-grained soil particles. Vertical distribution in West Lake shows high P concentrations at 20-30 cm with concentrations 29-48µg higher than the 15-20 cm range. These concentrations are most likely from the historical drainage of a nearby livestock pasture. In conjunction with this, it is hypothesized that a flood event deposited increased quantities of sediment into West Lake. This may have caused P at depth to rapidly become unavailable for uptake. The responsible flood event is most likely from the large Midwestern United States flood in 1993. Unlike West Lake, the average vertical gradient of Railroad Lake shows a downward trend of P concentration. This was thought to be a land use factor; however, chemical change of P to an inorganic form not detectable by the ascorbic acid method of P testing may also cause this trend. The observed P levels were comparable between Railroad Lake (499µg/g) and West Lake (449µg/g). The lateral P distribution was studied around West Lake. This distribution shows high P concentrations in the livestock area as well as high P concentrations near T5S1 and T1S1.

GEOLOGY

Presiding: John Groves
Saturday, April 26, 2003: 8:00 a.m. - 10:40 a.m. ~ Room 318

8:00 a.m. Completion of the digital maps of the bedrock geology and topography of South-Central Iowa: Phase 4 of the STATEMAP Iowa Bedrock Mapping Program

Iowa Geological Survey, 109 Trowbridge Hall, Iowa City, IA 52242-1319

In the Summer of 2002 staff geologists at the Iowa Geological Survey (IGS) completed work on the Digital Maps of Bedrock Geology and Topography for 17 counties in South-Central Iowa. This project, Phase 4 of the Iowa Digital Bedrock Mapping Project, supported by the IGS and the USGS STATEMAP Geologic Mapping Program, when combined with the 48 northern Iowa counties completed in the first three phases of the program, marks the completion of mapping of over 75% of the Iowa. The use of digital soils map data to produce the map of bedrock topography, and the use of bedrock topography as a major control for the geologic mapping, has allowed the production of much more detailed maps in the areas of shallow unconsolidated cover over bedrock. The geology of the southwest Iowa study area is dominated by Pennsylvanian rocks,
which were mapped at the group level. Of special interest is the first detailed map along the Thurman-Redfield Fault Zone in the study area, the discovery of a previously unreported fault in Dallas County, and a new interpretation of the geology along the Middle River. The geologic map of the study area also provides a much more accurate and detailed mapping of the erosional edge Cretaceous strata in the area.

8:25 a.m.  **Stratigraphy and foraminiferal extinction in the Permian-Triassic boundary interval, western Taurides (southwest Turkey)**

**J.R. GROVES, M.D. BOYCE, and B.J. CRAIG**

Department of Earth Science, University of Northern Iowa, Cedar Falls, IA 50614-0335

Foraminifers are abundant in latest Permian strata in the Tauride Mountains of southwest Turkey. They occur in wackestone and packstone lithologies along with diverse marine invertebrates and calcareous algae. The Permian-Triassic boundary is marked by the abrupt disappearance of most foraminifers. At this level, Upper Permian bioclastic lithologies are replaced by Lower Triassic unfossiliferous stromatolites and oolites.

The only foraminifers recovered from Lower Triassic strata in the Taurides are *Earlandia* and *Rectocornuspira*, which are considered "disaster taxa." The stromatolitic and oolitic beds that contain these taxa likewise have been interpreted as "disaster deposits," i.e., microbially influenced sediments that accumulated under inimical conditions, in the absence of normal marine invertebrates.

The pattern of foraminiferal disappearance is consistent with catastrophic extinction, as has been documented at the Permian-Triassic boundary throughout the Paleotethyan region. Stromatolitic and oolitic deposits above the extinction level may have formed in anoxic environments, but it is not clear that the end-Permian extinction was caused by anoxia.

8:50 a.m.  **A comparison of the taphonomy of modern and ancient mollusks in sea grass beds**

**L. JOHNSON and B. GREENSTEIN**

Dept. of Geology, Cornell College, Mt. Vernon, IA 52314

Delineation of taphonomic signatures - taphofacies - on fossil material has been shown to be an effective complement to sedimentologic and paleontologic data. Since physical, biological and chemical processes can leave a potentially preservable imprint on shell material, comparative taphonomy of taphofacies can determine the original habitat of fossilized assemblages when existing data are inconclusive. By looking at variations in preservation of specific organisms, inferences about different depositional environments can be made. However, the degree to which taphofacies analysis can indicate a specific depositional environment for a fossil assemblage has not been assessed adequately. In this study, a comparison was made between the taphofacies present on mollusks obtained from a modern sea grass bed and those obtained from a facies interpreted to represent a Pleistocene sea grass environment. If the distribution of taphonomic characters described from the modern assemblage is matched by those obtained from its Pleistocene analogue, then taphofacies for the modern environment have been preserved. Five
hundred shells were collected from a Pleistocene sequence exposed in a quarry on San Salvador Island, Bahamas. Each shell was examined under a microscope and the degree of coverage by a variety of taphonomic characters was measured.

No significant (a=0.05) difference in the distribution of characters was measured between the fossil and modern assemblages, although differences in the degree of coverage of some of the characters existed. Fragmentation values in the Pleistocene sample were elevated, due in part to laboratory methods: removal of the mollusk shells by chisel may have broken off fragments of previously intact shells. Additionally, dissolution values in the Pleistocene sample may also be elevated because acid was used to free the shells from surrounding matrix. Although these differences in taphonomic averages are noteworthy, the similarity in distribution of taphonomic characters between the modern and ancient assemblages suggest that, for recognizing depositional environments whose dominant organism is inherently non-preservation (sea grass), application of the taphofacies concept is especially useful.

9:15 a.m.  **BREAK**

9:30 a.m.  **Climate indicators detected in annual growth bands of Pleistocene Montastraea collected from Belize, Central America**

J. LEONARD, B. GREENSTEIN, and L. GREER

Cornell College, 600 First Street W., Mt. Vernon, IA, 52314

Scientists interested in global climate change have increasingly turned to proxy climate records provided by stable isotopic and elemental analyses of massive coral skeletons. Because of their relatively slow growth rate (mm per year), long life spans (centuries) and accretionary mode of growth, the skeletons of corals with massive colony growth forms can potentially record sea surface temperature and salinity changes at many temporal scales. Moreover, geochemical analyses of coral skeletal material are often the only proxy climate record available from low latitudes.

The last interglacial (Sangamon, oxygen isotope substage 5e) was a time of rapid and pronounced climate change. The purpose of this project is to determine whether seasonal and/or decadal scale cyclic changes in sea surface temperatures occurred during the interval. Four specimens of the coral *Montastraea annularis* were collected from a fossil reef exposed adjacent to the northern barrier reef tract in Belize, C.A. U-series dates obtained using alpha spectrometry have indicated a last interglacial age for the reef assemblage. From each coral, a representative 20-year interval was sampled by obtaining four samples per annual growth band. A total of 320 samples (4 corals x 20 annual growth bands x 4 samples/growth band) are currently undergoing stable isotopic (δ¹⁸O) and elemental (Sr/Ca) analyses. We hope to be able to detect high-resolution seasonal and decadal climate cycles, and compare our results to a companion study of modern specimens of *Montastraea* collected offshore from the Pleistocene locality.

9:55 a.m.  **Numerical Simulation of the Coupled Pelagic and Benthic Ocean Carbon Cycle**

J. FANG, T.C. CHEN, and C. KATO*

Department of Geological and Atmospheric Sciences, Iowa State University, Ames, IA 50011
The deep-sea piezophilic microbial ecosystem is a critical component of the past and present
global biogeochemical cycles and can also serve as a model for life on other planets or moons
(e.g., Mars and Europa). The existence of distinct and diverse assemblages of piezophilic bac-
teria are emergent properties and an inevitable consequence of the deep-sea environments and
coupled global biogeochemical cycles. In this study, we used polyunsaturated fatty acids (PUFAs)
to link the surface ocean biological production and deep-sea piezophilic biosynthesis. PUFAs are
produced by both phytoplankton in the surface ocean and by piezophilic bacteria in the deep-sea
sedimentary environment. Our model consists of fourteen biotic and abiotic compartments, eight
in the water column, and six in sediment. Biotic compartments include the primary producers
(phytoplankton) and consumers (bacteria, zooflagellates, protozoa, and zooplankton) in the water
column and piezophilic bacteria, non-piezophilic bacteria, and grazers in sediment. The abiotic
components include particulate-PUFAs, dissolved-PUFAs, and the dissolved nitrogen pools in
seawater and pore water. Model simulation suggests that there is a dynamic coupling between
the surface primary production and deep-sea bacterial metabolic processes.

10:20 a.m.  SECTION BUSINESS MEETING

POSTERS

12.  Using an on-campus monitoring well site to increase teaching effectiveness in
hydrology courses

M.Z. IQBAL

Department of Earth Science, University of Northern Iowa, Cedar Falls, IA 50614

The objective of this project was to develop laboratory exercises involving the newly constructed
on-campus water monitoring well site at the University of Northern Iowa, USA. The well site
includes eight PVC wells (10 - 20 ft) and two bedrock wells (70 - 90 ft). The long-term goal of the
project is to turn the well site into a model outdoor instructional resource for the undergraduate
students in areas of hydrology and environmental science.

The project was helpful for undergraduate students to develop critical thinking skills and scientific
literacy. Students were involved in hands-on activities, such as water sampling, on-site chemical
analysis, well purging, preparing flow-nets, mapping water table contours, etc. Also, they studied
groundwater flow by injecting ion tracers such as bromide and chloride. The well site served
as a link between the classroom learning of concepts and their actual field application. While the
shallow wells were useful for unsaturated flow exercises the deeper bedrock wells were very
effective in simulating the hydrologic environment in the area. The hands-on activities allowed
them to understand how the land use practices were responsible for subsurface water pollution
and their environmental consequences. The students had an opportunity to work as a team. They
experienced the very essence of science, which consists of elements like curiosity, developing
hypotheses, observation, synthesis of observed data, reasoning, offering constructive arguments,
and conclusions.
13. A 4,000-year vegetation record from speleothem stable isotopes in Devil’s Ice Box cave, central Missouri

M. DUPREE, R. DENNISTON, Y. ASMEROM, and S. CARPENTER

Cornell College, 810 Commons Circle box 274, Mount Vernon, IA 52314

Carbon and oxygen stable isotopic profiles have been constructed from three late Holocene stalagmites (Dl-01-01, Dl-01-02, and Dl-01-03) from Devils Ice Box cave, on the northern edge of the Ozark Plateau. Chronologies are anchored using two U-Th TIMS dates on Dl-01-01 and Dl-01-02, and one TIMS date on Dl-01-03. The oxygen isotopic profiles for each are similar (approx. -5 per mil), although Dl-01-03 varied significantly (-4.95 +/- 0.58 per mil). In contrast, the carbon isotopic signatures of each stalagmite are quite distinct. Sample Dl-01-01 contains a carbon isotopic trend which is consistent with other regional speleothem records, suggesting a transition from a prairie/grassland ecosystem to forest at approximately 1500 yr BP. Dl-01-02 is characterized by consistently high (-2 per mil) d13C values, suggesting continuous prairie over the cave throughout the late Holocene. Dl-01-03 contains consistently low (-10 per mil) d13C values throughout the same interval, suggesting continuous forest. The samples also differ in appearance; Dl-01-01 is composed of dense, optically clear calcite, while Dl-01-02 is similar, but more porous, and Dl-01-03 is composed of porous, milky white calcite with abundant clays. The origin of these optical and isotopic differences is unclear, however, the porous nature of Dl-01-02 and Dl-01-03 makes their isotopic records suspect. Therefore, Dl-01-01 is most likely to contain an accurate record of vegetation in the area during the late Holocene.

PHYSICS

Presiding: C. Clifton Chancey
Saturday, April 26, 2003: 8:20 a.m. - 10:20 a.m. ~ Room 312

8:20 a.m. Iowa Electrathon, join us – you’ll be electrified

A. FITZPATRICK

Iowa Electrathon Director, University of Northern Iowa, Cedar Falls, IA 50614-0293

Electrathon is a program for high school, community college, and university students to research, design, build, and race one person electric vehicles. The cars are powered by two automobile batteries and an electric motor. The project requires an understanding of many scientific principles, including: friction, aerodynamics, electronics, kinematics, etc. The program exemplifies inquiry based science with its project orientation and student driven research and construction components.

Electrathon teams may work during Electrathon classes and/or after school. Financing for the project is primarily done with student fundraisers and local business sponsorship. Advisors are often science or industrial technology teachers. High Schools with Electrathon teams include Cedar Rapids Kennedy, Prairie, St. Ansgar, Forest City, Pomeroy-Palmer, Muscatine, Jefferson-Scranton, Ogden, Sioux Central, Manson Northwest Webster, and Waukee. North Iowa
Community College has a new team this year, and individual students have also built and entered cars for competition.

The Iowa Electrathon program began in 1996. There are Electrathon programs in CA, OR, NB, KS, MI, ME, and CT. Iowa Electrathon is sponsored by Alliant Energy and the Iowa Energy Center. For more information check our website at www.uni.edu/ceee/electrathon.

8:40 a.m.  **A method for simplifying error estimation for non-linear cases**

**J.W. PATTERSON**

(Retired) ISU Professor of Materials Science and Engineering, 3603 Woodland Street, Ames, IA 50014-3440

A novel method is outlined for estimating the uncertainty of a physical quantity $y$ whose dependence on the variables $u$, $v$, $w$, etc. conforms to a known formula or fitting function. Ordinarily, one simply invokes the traditional "propagation of errors" and wades through mathematical effort needed to derive whatever differential coefficients may be required by this approach. This can be laborious—not to mention vexing—especially when one or more of the independent variables appear, as they often do, in non-linear clusters, such as $u/wv$, and the like or, worse yet, when the cluster appears as an exponent. In such cases, however, one can make judicious use of the log transformation in such a way as to greatly simplify the mathematical manipulations required to estimate the error in the physical quantity, $y$, given those in $u$, $v$, $w$, etc. To demonstrate, some familiar non-linear cases will be analyzed, ranging from the very simple Ohm's law, $I = V/R$ to the rather complex Arrhenius temperature factor $y = A \exp(-Q/RT)$—plus others as time allows.

9:00 a.m.  **Using the Excel spreadsheet to make physics simulations for beginning classes**

**T.C. GIBBONS**

Clinton Community College, 1000 Lincoln Blvd., Clinton, IA 52732

The Excel spreadsheet includes various features that allow it to be used for simulations. These features include macros, functions, formulas, the random number generator, the ability to recalculate the screen using the F9 key, and the repeat feature which allows formulas to be recalculated repeatedly. During this talk several such simulations that I have written for introductory physics, physical science, and astronomy will be demonstrated.

Most of these involve waves, and they allow students to visualize and experiment with the meaning of wavelength, frequency, and other basic wave concepts as well as wave interference. Interference simulations include the combining of waves into standing waves, beats, and some more complex forms. Two of the simulations attempt to show individual photons forming a double slit interference pattern and a picture.

I will show some ways in which I have used these in individual student labs and in class demonstrations, and I will discuss some informal student evaluations of such use.
9:20 a.m.  **Between Copernicus and Galileo**

**J.W. ZWART**

Dordt College, 498 4th Ave NE, Sioux Center, IA 51250

Most physics texts' discussion of the transition from the geocentric to the heliocentric model of the solar system focus on Galileo and ignore the more than 60 year period between the publication of Copernicus' *On the Revolution of the Heavenly Spheres* and Galileo’s promotion of, and eventual forced recantation of, the Copernican model. A closer look at the history of this time period provides insights into the acceptance of the Copernican model and the relationship of religion and science.

9:40 a.m.  **Mortality of adult zebra mussels (*Dreissena polymorpha*) exposed to extremely low frequency electromagnetic fields**

**C.C. CHANCEY and M.F. RYAN**

Department of Physics, University of Northern Iowa, Cedar Falls, IA 50614-0150

*School of Medicine, Indiana University - Purdue University at Indianapolis, Indianapolis, IN

Zebra mussels have increasingly infested inland US waterways since their accidental introduction in the 1980's. Their filter-feeding requirements cause them to proliferate near and within intake pipes, blocking water flow and leading to the expenditure of billions of dollars to control infestation yearly. Zebra mussels have been implicated in the rise of chlorinated pesticides in fish species such as lake trout, a result of the mussels' accumulation of toxins during feeding. Using strong oxidants such as chlorine dioxide can control mussel infestation, however these chemicals can kill non-targeted animals. This presentation discusses an alternate strategy for control: extremely low frequency electromagnetic (ELF EM) fields that offer a non-chemical method of control of infestation. Experimental evidence will be presented of the effectiveness of ELF EM as a non-chemical method of control.

10:00 a.m.  **SECTION BUSINESS MEETING**
PHYSIOLOGY

POSTERS

14. Monitoring of skin and end-tidal PCO$_2$ during hemorrhage and resuscitation


IMMC Surg. Ed & Trauma Research*, and Drake University, Des Moines, IA 50311

We investigated changes in skin PCO$_2$ and end-tidal CO$_2$ as non-invasive indicators of hemorrhage severity. **Methods:** 8 anesthetized dogs were hemorrhaged (MAP=35-40mmHg) and resuscitated (MAP=75-80mmHg with lactated Ringer's). Skin PCO$_2$ was monitored with a 37OC, Severinghaus-type sensor. Cardiac output (CO) was monitored by thermodilution. **Results:** During hemorrhage, as CO declined, skin PCO$_2$ steadily increased, and end-tidal PCO$_2$ decreased. At initiation of resuscitation, end-tidal PCO$_2$ responded as rapidly as CO while skin PCO$_2$ started a gradual decline after a brief lag time. **Conclusions:** Assessing hemorrhage severity non-invasively is challenging. Others have shown associations between decreased trauma survivorship and the highest peri-operative skin PCO$_2$s (with 44OC heated sensors) and the lowest peri-operative end-tidal PCO$_2$s. This study shows that skin PCO$_2$ increases steadily and end-tidal PCO$_2$ decreases with the declining CO that occurs with hemorrhage. In response to fluids, CO and end-tidal PCO$_2$ increase rapidly while decreases in skin PCO$_2$ require more time. Non-invasive monitoring of skin and end-tidal PCO$_2$ might be useful for triage. (Support: IMMC, Drake, DSM VA Med Ctr, ISGC/NASA)

15. Effect of enalaprilat on regional blood flow during resuscitation


IMMC Surg. Ed & Trauma Research*, & Drake U, Des Moines, IA 50311

Administration of enalaprilat, an angiotensin-converting enzyme inhibitor, before hemorrhage prevents a selective decrease in the percent of cardiac output (CO) to the gut. We hypothesized this selectivity would occur with administration of enalaprilat during resuscitation. **Methods:** 8 anesthetized dogs were hemorrhaged (MAP=35-40mmHg, 90min) and resuscitated (R; MAP=75-80mmHg, lactated Ringer’s and packed red blood cells, 230min). Enalaprilat (0.02mg/kg/hr) was started 40min into R. Regional blood flows (transit time ultrasound sensors) and CO (thermodilution) were monitored. **Results:** CO and regional flows were higher after starting enalaprilat (p<0.05 each ANOVA). The percent of CO to each region was unaffected by enalaprilat. **Conclusions:** Enalaprilat administration during resuscitation increased gut blood flow, but did so by increasing CO with no effect on blood flow distribution. This may be beneficial post-trauma for maximizing total and regional blood flows. Reasons for a lack of selectivity might include resus-
citation MAP used (angiotensin II mesenteric effects are affected by blood pressure), angiotensin II receptor changes caused by hemorrhage, or changed feedback between the sympathetic and renin-angiotensin system. (Support: IMMC, Drake, DSM VA Med Center, ISGC/NASA)

16. Non-invasive monitoring of skin and end-tidal PCO$_2$ for triage

E. GRIMWOOD, A. WINDSPERGER, H. DUDA, R. ROPER, M. FIEDLER, A. MATLACK, O. COUTURE, C. BUIISING, L. HENDERSON, and P. WALL*

IMMC Surg. Ed & Trauma Research* & Drake U, Des Moines, IA 50311

Triage at a multiple trauma scene can be challenging. In the peri-operative setting, persistently increased gastric PCO$_2$s, severe base excesses, the highest skin PCO$_2$s, and the lowest end-tidal PCO$_2$s correspond to decreased trauma survival. Gastric PCO$_2$ and base excess are difficult to assess in the field, and the heart rate, gastric PCO$_2$, and base excess changes seen with trauma also occur with exercise. Skin and end-tidal PCO$_2$ could be non-invasively monitored in the field so we evaluated how they were affected by exercise to determine if they have triage usefulness. Methods: After baseline readings, 12 volunteers ran on a treadmill for 30 min at 75% of their calculated maximum heart rate. Skin PCO$_2$ was monitored with a 37°C Severinghaus-type sensor. Results: During exercise, heart rate increased, end-tidal PCO$_2$ increased initially, and skin PCO$_2$ decreased slightly. Conclusions: This study shows that skin and end-tidal PCO$_2$ changes incurred during exercise are opposite to those incurred during trauma. This may prove useful in distinguishing between patients with serious injury and blood loss from those with minor injuries and sympathetic activation. (Support: IMMC, Drake, Des Moines VA Med Center, ISGC/NASA)

17. Using antigen antibodies to detect coccoid Helicobacter pylori

A. WHITTERS and N.P. BERNSTEIN

Mount Mercy College, 1330 Elmhurst Dr. NE, Cedar Rapids, IA 52402

A group of patients were tested for presence of Helicobacter pylori in their gastrointestinal tract. H. pylori is felt to cause most gastritis problems, almost all duodenal ulcers, and it can be related to gastric malignancies, especially lymphoma. Diagnosing for presence of H. pylori can be difficult and/or expensive. One potential test involves staining gastrointestinal tissues with a diff-quick stain, also known as CLOE. Biopsies of G.I. tissues were tested for both presence of H. pylori and response to CLOE stain to determine whether CLOE was effective in determining presence of H. pylori.
8:15 a.m.  **A key to the eggs and nest of Iowa’s turtles**

**J.L. CHRISTIANSEN and J.R. PARMELEE**

Department of Biology, Drake University, Des Moines, IA 50311  
Department of Biology, Simpson College, Indianola, IA 50125

Biologists often need to identify destroyed turtle nests where a predator has excavated and eaten the eggs. We present a dichotomous key to the eggs and nest of Iowa’s turtles. Egg and nest morphology clearly separated most nest of families Chelydridae and Kinosternidae and many of the Emydidae. However, egg morphology must be combined with known range to distinguish wood turtles, *Clemmys insculpta*. These factors will also separate most false map turtles (*Graptemys pseudogeographica*) from other species. Similarities among egg morphologies, nest morphologies, and ranges make all map turtles (*Graptemys*) and red-eared turtles (*Trachemys*) difficult to separate in southeastern Iowa.

8:30 a.m.  **Scent-trailing by newborn timber rattlesnakes (*Crotalus horridus*) and Asian sunbeam snakes (*Xenopeltis unicolor*)**

**J. PARMELEE and T. MOHROR**

We examined the ability of snakes to follow scent trails left by conspecifics using a y-maze, leading a scent-leaving subject through one arm of the maze and then allowing test subjects to travel down the maze and choose an arm. Previous studies on a few species of snakes, mostly vipers and garter snakes, have shown that males follow female scent trails. In the case of the timber rattlesnake it is thought that newborns follow their mothers to find a winter hibernacula. We repeated an earlier study and found similar results that newborn timber rattlesnakes follow a scent trail left by their mother (9/12 correct arm choices), and moved very little in control tests.

We then tested a primitive burrowing snake from south-east Asia, the sunbeam snake. Very little is known about the natural history of these snakes, and mating behavior has never been observed. We tested ten individuals, and the maze was filled with aspen chips to make these burrowing animals behavior more naturally. There was no significance in males following females (5 correct arm/3 incorrect arm), but surprisingly females followed males in all six trials. Female snakes following scent trails of males has never been documented and research is underway to further examine this, and the mating behavior of this species.
The status of the eastern massasauga rattlesnake in Iowa

T.J. VANDEWALLE and J.L. CHRISTIANSEN

Earth Tech, 501 Sycamore Street, Suite 222, Waterloo, IA 50703
Department of Biology, Drake University, Des Moines, IA 50311

The eastern massasauga rattlesnake is listed as endangered in Iowa and is a Candidate Species for listing as threatened by the USFWS. From 2000 to 2002, we surveyed known and historic massasauga populations in eight counties in eastern and southern Iowa in an attempt to determine the status of the eastern massasauga at each location and to locate new populations along the upper Wapsipinicon River in northeast Iowa.

Historical evidence suggests that in the past massasaugas were probably widespread across eastern and southern Iowa and were found in most places with suitable habitat. The results of this survey suggest that massasauga populations in Iowa are continuing to decline, including the populations that have historically been the most robust. Interviews with landowners and resource agency personnel in all areas where massasaugas still exist indicate that the snake is seen much less commonly today than it was 10 years ago, and certainly much less so than 20 - 30 years ago. Habitat loss, either by conversion to other land uses or by land management practices, appears to be the primary threat to massasaugas today. In 2002, a radio telemetry study was initiated to determine the activity range and habitat preferences of massasaugas along the Upper Wapsipinicon River. We thank the Iowa DNR and the USFWS for funding the survey.

SECTION BUSINESS MEETING

Small mammal abundance in four habitats and habitat selection in timber rattlesnakes (Crotalus horridus)

B. MAHER and J. PARMELEE
Department of Biology, Simpson College, Indianola, IA 50125

Parmelee and Frese have collected data on timber rattlesnake movements and habitat selection in Madison county, Iowa for two years. In this study we examined if habitat selection in timber rattlesnakes may be related to prey availability. Twenty-five snap traps were set out in four habitats (100 traps total) in our study area and monitored for 57 days in late fall, 2002. We captured eight species of small mammals including 2 shrews (Blarina brevicauda, Sorex cinereus), 2 voles (Microtus pennsylvanicus, M. ochrogaster), the deer mouse (Peromyscus maniculatus/leucopus), house mouse (Mus musculus), harvest mouse (Reithrodontomys megalotis), and jumping mouse (Zapus hudsonicus).

The grass habitat harbored the greatest diversity and abundance (37 individuals) of small mammals, followed by the rocky ledge (12), forest (9), and corn field (4) habitats. Rattlesnakes in 2002 were found mostly on the rocky ledge habitat (61%), followed by grass (34%), forest (6%), and were never found in the corn field (although they were found along the edge and in an alfalfa field). The abundance of small mammals in the grassy habitat may be a factor in rattlesnake habitat selection.
Incidence of intestinal protozoan parasites in Xantusia vigilis and Batrachoseps attenuatus of California mountainous regions. I. Syntopy influences on cross-parasitism

D. SOLEYMANI and A.R. SANCHO

Department of Biology. California State University, Dominguez Hills, Carson, CA 90747

We investigated the incidence of protozoan intestinal parasites and infection rates in California indigenous species of Xantusia vigilis (Desert night lizard) and Batrachoseps attenuatus (California slender salamander). These host-species are phenotypically different, yet they share common habitats, diets, and certain anatomical features. Both are found co-inhabiting the Foothill Woodland communities of the lower elevations within the Pinnacles National Monument, San Benito and Monterey Counties. Three collection sites were selected within 378 to 758 meters in altitude, and each particular site had its own microhabitat characteristics. A total of 21 and 22 specimens of X. vigilis and B. attenuatus respectively, were collected. Surgical extraction of stomach and intestinal contents from both host species, included ants (Phormakytes sp.), small termites (Kalothermes sp.) and varied vegetation. After careful microscopic examination of fecal materials, on fresh and stained slide mounts, the following intestinal protozoan parasites were identified: Proteromonas sp., Hexamita sp., Trichomonas sp., Chilomastix sp., Nyctotherus sp., and Balantidium sp. Four out of the six parasites were found in both hosts, and one solely in each host. Trichomonas sp. had the highest incidence rate in host species, 59 and 95 percent, respectively. Morphological differences between Trichomonas sp. found in either host were minimal. Variances in infection rates and incidence were mainly due to the individual host and not due to their biodistribution, since they were both found inhabiting in the same three collection sites. These findings substantiate the importance of co-inhabitance and the influence of syntopy on cross-parasitism between two phenogenetically different species.

Are fast males flashy? A test of the interaction between natural and sexual selection in Galápagos lava lizards (Microlophus albemarlensis)

J.L. HOLLIS and M.A. JORDAN

Department of Biology, University of Northern Iowa, Cedar Falls, IA 50614

While elaborate ornaments are thought to enhance an individual’s mating success, high levels of natural selection via predation may limit their potential to evolve. We test the hypothesis that predation pressure influences ornament size by investigating a population of Galápagos lava lizards (Microlophus albemarlensis) found on Isla Plaza Sur in the Galapagos archipelago. In contrast to lizards found on the western end of the island, eastern lizards occur in a habitat that has almost no vegetative cover. Past work has shown that lizards from the open habitat exhibit performance and behavioral traits associated with greater ability to avoid predators. We measured the area of the chin patch (CPA), an antero-ventral ornament in males and females known to have signal value, and snout-vent length (SVL) on individuals captured from across the island. Measurements were taken using image analysis software applied to digital photographs of the ventral surface of the lizards. With respect to SVL and habitat, females exhibited no variation in CPA. In males there was a strong relationship between SVL and CPA, and CPA was relatively larger in the open habitat after adjusting for SVL. Our results suggest that selection on ornaments may be stronger on males than on females, and that the chin patches of males may be used as
a signal to visually oriented predators that indicates the ability of a male to escape attack.

10:00 a.m.  Male compensatory courtship behavior in a vestigial stock of *Drosophila melanogaster*

E.S. ENGELMAN and F.B. SCHNEE

Loras College, 1450 Alta Vista, Box # 538, Dubuque, IA 52001

*Vestigial* (*vg*) is a mutant of *Drosophila melanogaster* (fruit fly), which has a reduced wing size, causing the male to be deficient in his ability to produce a courtship song, an essential component of courtship. For this reason, the *vg* stock should be difficult to maintain; however, the stock is extremely vigorous, suggesting that some compensatory courtship behavior has evolved. Because previous research in our lab has suggested that compensation occurred in the male, this experiment used male choice tests to examine the effects of wing size and genetic background on male preference. The results demonstrated that *vestigial* males prefer *vestigial* females to other females and suggested that although in part the preference for *vg* females is due to their reduced mobility, at least some of the preference is due to an alteration in genetic makeup of the *vg* stock.

10:15 a.m.  Habitat use by raccoons in Swiss Valley Park and Nature Preserve

A. BIXLER

Clarke College, 1550 Clarke Drive, Dubuque, IA 52001

The raccoon is one species that has adapted well to the presence of humans and the ways in which we alter the environment. The purpose of this study was to gather data on raccoons in an area including varied habitats, such as woods, lawn, row crop and residential. I studied raccoon (*Procyon lotor*) trap success and home range use in the varied landscape of Swiss Valley Park and Nature Preserve (Dubuque County). I set traps in three different habitat types: riparian woods, a wooded strip surrounded by mowed lawn and a wooded area bordering row crop. I obtained home ranges based on daytime den locations for 5 radio-collared raccoons. Preliminary results suggest that there are sex and age differences in trap success in the three different habitat types. Trap success also varied by month. Raccoons used both underground and tree dens. Dens were all located in woods but home ranges included agricultural and prairie habitat.

POSTERS

18.  Documentation of a historical bird egg collection

C.L. CHANDLER and C.A. MESEKE-WREN

Putnam Museum of History and Natural Science, 1717 W. 12th St., Davenport, IA 52804

In fall of 2001, the Putnam Museum received funding from the Riverboat Development Authority to re-house and document its historical Oology Collection. The collection was re-housed using acid-free materials, inventoried and cataloged, taxonomic and locality information was verified and, in many cases, updated, early numbering systems were noted and this detailed specimen
information was then computerized and linked to digital images of the eggs.

This paper details the documentation phase of the project. The importance of a preliminary investigation into the historical practices associated with particular types of collections is stressed, as is the use of original records and early correspondence and publications.

By increasing the accessibility to actual specimens and their associated information, similar projects have the potential to increase the awareness of the research and educational value of historical zoology collections and serve as an impetus to preserve them for future generations.

19. Fish population research in Little Sioux River watershed

D. PALIC, R. GRAJEDA, L. HELLAND, B. PEDERSEN, J. PRIBIL, A. WILSEY, and C. PIERCE

Iowa State University, NREM, Ames, IA 50011

The research of fish populations is considered a useful tool in describing natural conditions existing in waterways during faunistical and ecological surveys. Little Sioux River is situated west of Okoboji lakes and drains into the Missouri River. It is considered the largest Iowa tributary to this river. Flowing eastwardly through a meandering channel with a slope of 0.25 m/km, the Little Sioux River drains 11,673 km². Fish samples were collected on 11 sites and three methods in obtaining fish samples were used: electrofishing with an electric seine, a backpack electrofisher, and a bag seine. We collected data from all accessible previous studies of this basin and performed analysis searching for possible trends in species changes over time. Total of 21 survey covering 70 years in time (1932 - 2002) was analyzed. Estimated number of species was calculated using Chao 2 estimator.

The total number of identified fish species in our survey was 22. Average number of species found in Little Sioux River basin per survey was 22.62, with total of 67 species reported since 1890. Average Index of Biotic Integrity score was 38. Based on analysis of species richness, biomass, density and IBI scores, we conclude that Little Sioux River basin has not been significantly changed compared to previous research and that further data analysis and consistent sampling is needed for better evaluation of this interesting catchment.

20. Mating behavior of Drosophila melanogaster with the apterous mutation

A.M. MOLITOR and F.B. SCHNEE

Loras College, 1450 Alta Vista, Dubuque, IA 52004

Study of laboratory stocks of Drosophila melanogaster has provided numerous examples of how easy it is to disrupt courtship. These stocks have also provided us with insight into how courtship systems can respond to change. For example, Bastock (1956) found that in yellow, a male deficiency in courtship ability was balanced by an increase in female receptivity.

This experiment compared the mating behavior of apterous (ap) flies to wild-type (+) flies by single pair and male choice tests. Ap is required for wing development, and produces males that are deficient in their courtship song. Preliminary results demonstrated that in addition to the obvious effect of ap on male courtship, ap females are also deficient in their courtship. Ap females are less
attractive than + females (as measured by the % courtship they receive); however, this decrease seemed to be compensated by an increase in female receptivity. Additionally, ap males deviated from + male behavior, in that they seemed to have a greater preference for ap females than + females. These results may signify that deficiencies in courtship behavior, especially the lack of courtship song in aperous males, are compensated by alterations in both male and female behavior.

21. Physical and chemical analyses of the glassy skeletons in six marine sponges representing two sponge groups

F.R. SANDFORD

Coe College, Cedar Rapids, IA 52402

The siliceous skeletons of four hexactinellids and two demosponges were examined and compared using a series of physical and chemical tests. The operating hypothesis was that testing might reveal noteworthy differences in the nature of the amorphous hydrated silica skeletons in Demosponges and Hexactinellids, that could prove taxonomically useful. Physical properties studied included SEM, glass density, glass transition temperature (Tg), TG/DTA to determine water content, and FTIR spectra. Chemical makeup was made using energy dispersive X-ray fluorescence (EDXRF). In all the spicules were formed by concentric layering of silica around the axial canals. With the exception of a few differences at several bands in the IR spectra, all sponges had similar skeletons. Density was similar in all (range 2.04 - 2.14 g/cc) and similar to that of opal (SiO$_2$ . 1.5H$_2$O) (ave. = 2.09 g/cc). IR spectra were similar with prominent absorption bands at 460-470, 800, and 1090-1100 cm$^{-1}$ (due to different vibrational modes of Si-O-Si linkages) and at 1650 and 3450-3560 cm$^{-1}$ (due to water). The skeletons of all 6 showed similar spectra to that of silica gel, both before and after heating to 1200° C. Water comprised 10-14% of the skeleton by weight. Average spicule chemical composition was 85.2% SiO$_2$, 12.3% water, and 2.5% other elements (mainly S, Al, K, Ca, and Na). The % amounts of Si did not differ significantly between demosponges and hexactinellids (Mann-Whitney test, P = 0.93, ns).

22. Iowa coyotes (Canis latrans) and the mesopredator-release hypothesis: Is it a dog-eat-dog world?

F.P. STEIN and V.M. ECKHART

Grinnell College, Department of Biology, Grinnell IA 50112-1690

The mesopredator-release hypothesis (which refers to mid-sized predators such as raccoon and fox as "mesopredators") predicts that an increase in top predator abundance will result in decreased mesopredator abundance, thereby causing an increase in the abundance of mesopredator prey not shared by the top predator. Several correlational studies in the U.S., involving coyotes as top predators and passerine birds as the "released" prey, show strong support for the mesopredator hypothesis. We tested predictions and assumptions of the hypothesis in Iowa. Analysis of 36-year trends in grassland passerine abundance (taken from the USGS Breeding Bird Survey) and of coyote harvests (taken from Iowa Department of Natural Resources records) show an oscillating increase in coyote harvest and steady declines for all but eight of twenty birds surveyed. This pattern opposes the predictions of the hypothesis. Mesopredator abundances (also assessed by fur-harvesting records) loosely parallel coyote abundance, generally following
similar patterns of peak and decline, rather than showing negatively correlated abundances as the hypothesis would predict. Preliminary results from dietary analysis of coyotes in Jasper County also fail to support the hypothesis. Current findings suggest that coyotes in this area do not eat mesopredators, and so would have no indirect impact on passerine populations through that pathway. Thus, population and preliminary diet analyses in Iowa suggest that the mesopredator hypothesis may have little validity in this area.

MUSSELS SYMPOSIUM

Presiding: David Lyon
Friday, April 25, 2003: 8:00 - 10:30 a.m. ~ Capital Room

8:00 a.m.  Historical changes in freshwater mussel biodiversity of North America and the Upper Midwest: The silence of the clams

K.S. CUMMINGS

Illinois Natural History Survey, Center for Biodiversity, 607 E. Peabody Dr., Champaign, IL 61820

Freshwater Mussels (*Margaritiferidae & Unionidae*) are perhaps the most endangered group of animals in North America. A 1993 review of the "state of the unionids" indicated that 72% of the approximately 300 species historically present in North America, are considered extinct, endangered, threatened, or of special concern. The primary reasons for the decline are habitat loss through dam construction, dredging and channelization, siltation, and impacts from exotic species. Other factors include loss of fish host(s), chemical pollution/contaminants, site-specific construction projects, commercial harvest, and drought caused by changes in hydrology. Losses in the Upper Midwest are similar to those in the rest of the country with the greatest losses occurring in the south: Minnesota (2 species extirpated - 4%), Illinois (19 species extirpated - 24%). Both large river and small stream faunas have been impacted. There appears to be a phylogenetic component to the losses with amblemines and lampsilines exhibiting the greatest declines. Anodontine mussels are largely unaffected and some may in fact be increasing in numbers and range. Recovery has occurred in some streams (Upper Illinois River, Mississippi River near the Twin Cities) but for many drainages source populations are not extant to repopulate depauperate rivers.

8:15 a.m.  Threatened by industry, saved by science: Mussel propagation at the Fairport Biological Station, 1914-1934

J. PRITCHARD

Department of Natural Resource Ecology & Management, 124 Science II, Iowa State University, Ames, IA 50011-3221

During the late 1800s, a prospering industry transformed millions of fresh-water mussels into lustrous shirt buttons, but mussel populations quickly declined. Button manufacturers called on science and the government to rescue their industry, and hence in 1914 the U.S. Bureau of Fisheries established the Fairport Biological Laboratory near Muscatine, Iowa, a Midwestern rival to the
famous Woods Hole Station.

G. Lefevre and W.C. Curtis began by examining the life cycle of mussels. From 1914 to 1922, Robert Coker organized propagation, but realized that dams, the navigation channel, and pollution would fundamentally alter mussel habitats. Max Ellis continued propagation efforts using sophisticated technique and an industrial model. Limited evidence for population recovery, Ellis's refusal to reveal his secret formula, a waning button industry and WWII caused the Bureau of Fisheries to cut propagation funding. Scientists' work, spanning natural history to pollution studies, paralleled larger issues on the Mississippi River. This study can be found at http://unionid.smsu.edu/Documents/fairport.pdf

8:30 a.m.  Discordant harmonies in fingernail clam populations (*Musculium transversum*) of Mississippi River backwater lakes

J. ECKBLAD

Department of Biology, Luther College, Decorah, IA 52101

The populations of *Musculium transversum* from 8 backwater lakes have been studied over a 29-year period based upon over 432 grab samples. These lakes in Pool 9 of the Upper Mississippi River range in size from 2 to 255 hectare surface area, mean depths from 0.2 to 0.9 meters, with mean water exchange times from 0.5 to almost 57 hours. Samples from the 1989-91 period suggested summer *Musculium* populations that had declined to about 9 percent of their mid-1970 levels. Deterministic models have attempted to explain this decline. More recent sampling suggests a substantial recovery of *Musculium* populations (mid-summer mean of 560 per square meter in 2002). Simple stochastic models, with realistic levels of POISSON and NORMAL variables, may provide a better explanation of population fluctuations than previously used deterministic models.

8:45 a.m.  Status of freshwater mussels in Iowa's reach of the Mississippi following the Invasion of the exotic zebra mussel (*Dreissena polymorpha*)

S.A. GRITTERS

Iowa Department of Natural Resources, PO Box 250, Guttenberg, IA 52052

The first documentation of the exotic zebra mussel (*Dreissena polymorpha*) in the Iowa reach of the Mississippi River was made in 1992 when a single zebra mussel was found near Bellevue. Between 1992 and 2002, Zebra mussels have colonized most of the firm habitat in the Mississippi River and now threaten the existence of native freshwater mussels.

Since the introduction in 1992, at least eighty field mussel surveys have occurred in Iowa's reach of the Mississippi River, which includes parts or all of twelve navigation pools. Mussel surveys were conducted for permitting, habitat rehabilitation or research purposes. In these studies, 36,439 live individuals were collected of 37 species. The most common species collected was Three-ridge (*Amblema plicata*), followed by pimpleback (*Quadula pustulosa*) and threehorn wartyback (*Obliquaria reflexa*). Eight of the 37 species were detected by only three live individuals or less. Presence of at least five species historically known to inhabit this river reach was not verified between 1992 and 2002.
9:00 a.m.  **Saving the Higgins’ eye pearlymussel (*Lampsilis higginsi*) from extinction**

G.J. WEGE

U.S. Fish & Wildlife Service, Twin Cities Ecological Services Field Office, 4101 East 80th Street, Bloomington, MN 55425-1665

Zebra mussels (*Dreissena polymorpha*) are an exotic species and a significant threat to native freshwater mussels of the Upper Mississippi River (UMR). At high densities, they compete for food, prevent opening/closing of shells, change habitat conditions from good to bad, and prevent successful reproduction and recruitment.

Zebra mussels attach to nearly all underwater objects including large boats using the federal navigation system of navigation locks and dams on the UMR. In April, 2000, the U.S. Fish & Wildlife Service (Service) determined that continued operation and maintenance of the federal 9-Foot Channel Project would jeopardize the continued existence of the federally-endangered Higgins’ eye pearlymussel (*Lampsilis higginsi*). To avoid jeopardy, the Service recommended the U.S. Army Corps of Engineers establish populations of Higgins’ eye in areas with no/few zebra mussels, and implement a zebra mussel control program. Since April, 2000, a variety of conservation measures have been implemented including genetics studies, mussel culture at the Genoa National Fish Hatchery, cage culture in the Upper Mississippi River and tributaries, stocking juveniles, relocating adults, stocking glochidia inoculated fish, cleaning and stockpiling adults, and survey/monitoring activities.

9:15 a.m.  **Application of genetic techniques to aid conservation of freshwater mussels: *Lampsilis higginsii* as an example**

B.S. BOWEN

Iowa State University, 124 Science II, Ames, IA 50011

Genetic techniques can be important tools to enhance efforts to conserve freshwater mussels. As a basis for conservation and management of mussels, it is important to characterize the genetic diversity within and among populations. Genetic techniques are especially useful in the management of endangered species, in which populations may differ genetically and in which population sizes are often small. Genetic techniques are currently being used in conservation planning for *Lampsilis higginsii*, the Higgins’ Eye Pearlymussel. *Lampsilis higginsii*, a federally endangered mussel in the Upper Mississippi River basin, has suffered a 50% reduction in range since 1965. It is currently threatened with extinction due to the alien zebra mussel (*Dreissena polymorpha*). Propagation and translocations to rivers that are free of zebra mussels are currently underway to help preserve this species. We used mitochondrial DNA to test the genetic similarity of populations from different locations and to determine the amount of genetic diversity in this endangered species. We found little genetic differentiation among the populations, but a high level of genetic variation within the populations. Based on this study, we recommended that to preserve this genetic variation, a large number of individuals should be used when animals are translocated or collected for propagation.
9:30 a.m.  **Relationship of declining mussel biodiversity to stream-reach and watershed characteristics in agriculturally impacted streams**

K.E. POOLE and J.A. DOWNING

Iowa State University, Department of Animal Ecology, 124 Science II, Ames, IA 50011

Freshwater mussels are among the most rapidly declining components of global biodiversity but causes of local species disappearances are frequently unknown. We estimated decade-scale local extinction by re-sampling 118 stream reaches representing the best mussel habitat across a region that was once rich in species and is now mostly converted from prairies and riparian woodlands to intensive agriculture (Iowa, USA). Average species richness was reduced from >5 to <2 species, maximum richness was reduced from 22 to 15 species, and all mussel species were extirpated from 47% of the reaches since 1984-1985. More than half of the sites lost >75% of their species. While five of the species were found at 20%-140% more sites in 1998 than 1984-1985, 29 species (83%) decreased an average 80% in geographic coverage, while eight species were completely lost from these stream sites. Correlation analyses with reach and watershed characteristics determined using GIS and local sampling methods link greatest declines to rarity of streamside woodlands, high siltation and most intensive agricultural land uses, i.e., where conditions had changed most from the historical land cover. The surveys indicated a very large extinction debt has been created by large-scale habitat modification over the last century and ongoing agricultural land uses.

9:45 a.m.  **Assessment of mussel populations in the Cannon River drainage and Superior National Forest, Minnesota**

G.E. WAGENBACH and M.C. SWIFT*

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The Cannon River in east central Minnesota historically had 18-20 species, some at high population density, before declines experienced in the 20th Century. A survey by M. Davis in 1988 documented Cannon River remnant populations. Mussels of Northern Minnesota waters have received little attention.

We assessed species presence and population density at selected sites studied by Davis (Cannon River and tributaries). Thirteen of fourteen species are still present including Strophitus undulatus, and Pleurobema sintoxia. The otherwise abundant Potamilis alatus is absent upstream from a dam in the city of Owatanna. Removal of the Owatanna dam, scheduled for 2004, will provide an opportunity to test the assertion that P. alatus distribution is controlled by the distribution of its fish host, the freshwater drum (Aplodinotus grunniens). We also searched, for the first time, 11 lakes in the upper Range River drainage in Superior National Forest. Eight / eleven lakes there contained populations of Pyganodon grandis and two / eleven Utterbackia imbecillis.
10:00 a.m.  **Aspects of an interior stream clam midden from 1913**

D.W. SCLICHT

Cedar Rapids Washington High School, 2205 Forest Dr, SE, Cedar Rapids, IA 52304

During clam surveys on the Wapsipinicon River in 1991, buried clams were observed in the bank of the river at Quasqueton, Buchanan County, Iowa. An interview with the landowner revealed that the clams were from a local claming operation in 1913. Excavation and examination of many of the clams reveal interesting differences in species composition and size, when compared to more recent specimens from the river.

Observations on the midden were recorded. Species determinations and size comparisons with modern clam fauna were made. The observed differences may imply unique evidence for changes in the water quality and biotic community of the river in the past 90 years.

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**IOWA'S ENERGY FUTURE**

Presiding: Tom Wheelock and Bion Pierson
Friday, April 25, 2003: 8:00 a.m. - 10:30 a.m. ~ Wedgwood Room

8:00 a.m.  **The potential for producing fuels and chemicals from biomass**

N.K. OLSON

Iowa State University, Ames, IA 50011

Prior to the 1940's numerous chemicals were derived from plant material (biomass). During the 1940's chemicals made from low-cost petroleum gradually began to replace these biomass-based chemicals, a trend which continued to gain strength for the remainder of the century. Petroleum-based chemicals now dominate the organic chemical market.

Technological developments combined with relatively higher petroleum prices have sparked a renewed interest in producing chemicals and fuels from biomass. The benefits to the rural economy of transitioning from a petroleum-based economy to a bio-based economy are potentially enormous.

Some of the conversion technologies and the potential economic impact of biomass-based chemicals will be discussed in this presentation.
8:25 a.m.  **Carbon trading, greenhouse gas emissions, and life cycle engineering of Iowa biomass projects**

**J.L. SCHNOOR and R.A. NEY**

University of Iowa, College of Engineering, Iowa City, IA 52242

Trading of carbon credits is already occurring in countries that have ratified the Kyoto Climate Accords. A nascent carbon trading market is developing in the United States on a voluntary basis, and it could grow significantly with new legislation. The Chicago Climate Exchange has enrolled 14 industries committed to a goal of reducing their emissions by 4.0 percent based on 1998-2001 levels.

In this paper, we will discuss research on the potential for carbon sequestration in Iowa forests and soils, riparian zone buffer strips and multi-pollutant trading credits to improve water quality, and life cycle assessments to evaluate biomass projects. One case study is the Chariton Valley RC&D biomass project near Ottumwa, Iowa, where a 650-MW coal-fired power plant has been retrofitted to burn 5% switchgrass in lieu of coal. Wind energy, microturbines, and capturing methane at hog lots are also discussed.

8:50 a.m.  **Hydrogen from biomass**

**R.C. BROWN**

Iowa State University/Center for Sustainable Environmental Technologies, Ames, IA 50011-3020

The goal of this project is to optimize performance of an indirectly heated gasification system that converts switchgrass into hydrogen-rich gas suitable for powering fuel cells. We have developed a thermally ballasted gasifier that uses a single reactor for both combustion and pyrolysis. Instead of spatially separating these processes, they are temporally isolated. The producer gas is neither diluted with nitrogen or the products of combustion. The heat released during combustion at 850°C is stored as latent heat in the form of molten salt sealed in tubes immersed in the fluidized bed. During the pyrolysis phase, which occurs at temperatures between 600 and 850°C, the reactor is fluidized with steam rather than air. Heat stored in the phase change material is released during this phase of the cycle to support the endothermic reactions of the pyrolysis stage.

The approach to this project is to employ a pilot-scale (5 ton per day) gasifier to evaluate the thermally ballasted gasifier as a means for producing hydrogen from switchgrass. Gasification at the pilot scale is important for obtaining realistic process data, especially for calculating energy flows through the system and assessing the practicality of feeding switchgrass into the gasifier. A slipstream from the gasifier is used to evaluate gas cleaning and upgrading options. This slip stream includes: a guard bed designed to remove hydrogen sulfide and hydrogen chloride and some tar; a steam reformer designed to crack the remaining tar and decompose ammonia; and high temperature and low temperature catalytic water-gas shift reactors to remove carbon monoxide from the product gas and increase its hydrogen content.
10:05 a.m.  Solar energy: past, present and future

L. HODGES

Department of Physics and Astronomy, Iowa State University, Ames, IA 50011-3160

The history of some of the major uses of solar energy in Iowa will be reviewed and the present situation will be described. The main emphasis will be on uses of solar energy in buildings, and will include some of the presenter's personal experiences.

The presenter will also offer some opinions (predictions, hopes) about the future.
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