

2004


## 116th Annual Meeting of the Iowa Academy of Science [Program, 2004]

Iowa Academy of Science

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

April 23-24, 2004



University of Northern Iowa  
Cedar Falls, Iowa

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Iowa Academy of Science  
175 Baker Hall – UNI  
Cedar Falls, Iowa 50614  
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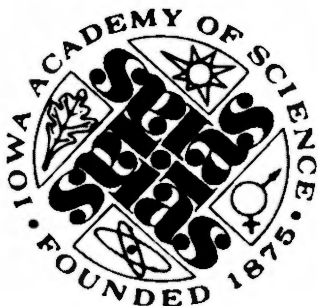
**Special Thanks**

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

The University of Northern Iowa  
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NASA - Solar System Forum  
The GLOBE Program/GLOBE ONE  
Iowa Space Grant Consortium  
Iowa Project WET & Nestle Waters  
Pella Rollscreen Foundation  
Neal Iverson, Barbara Freese, Todd Heinrichs  
  
2004 IAS Officers, Section Chairs, Vice Chairs, Committee Members, Speakers, and other volunteers.

## Table of Contents

|   |    |
|---|----|
| Notes Page .....  | 3  |
| Friday Program Summary .....                            | 4  |
| Senior Academy Poster Presentation Titles .....         | 5  |
| General Session Speakers .....                          | 7  |
| Symposia Programs .....                                 | 8  |
| Saturday Program Summary .....                          | 9  |
| Section Meeting Programs (Alphabetical by Section)..... | 9  |
| 2004 Awards .....                                       | 14 |
| Abstracts (by Section).....                             | 15 |
| Author Index .....                                      | 42 |



### The Academy's Mission:

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

Associated with the American Association for the Advancement of Science.

## Notes

## Friday Program Summary April 23, 2004

| Time        | Activity                                | Location                          |
|-------------|---|-----------------------------------|
| 8:00-12:00  | Registration                            | MSH Ground Floor Lounge           |
| 8:00-12:00  | IAS Bookstore & USGS Booth              | MSH 1 <sup>st</sup> Floor Lounge  |
| 8:00-11:00  | Continental Breakfast                   | MSH 1 <sup>st</sup> Floor Lounge  |
| 8:00-8:30   | IJAS Poster Set-up                      | Union Expansion A & B             |
| 8:00-5:00   | Senior Poster Set-up                    | Union Expansion A & B             |
| 8:30-11:30  | IJAS Poster Session                     | Union Expansion A & B             |
| 8:30-11:30  | IJAS Presentations                      | Union College Eye & State College |
| 11:00-12:00 | General Session I                       | TBA                               |
| 12:00-1:30  | Awards Luncheon                         | Union Expansion A & B             |
| 1:30-5:00   | Registration                            | MSH Ground Floor Lounge           |
| 1:30-5:00   | IAS Bookstore                           | MSH 1 <sup>st</sup> Floor Lounge  |
| 2:30-3:00   | Refreshments                            | MSH 1 <sup>st</sup> Floor Lounge  |
| 2:00-2:30   | IAS Business Meeting                    | MSH 1                             |
| 2:30-3:00   | Standing Committee Meetings             | See box below                     |
| 3:00-5:00   | Symposia (see page 9)                   |                                   |
|             | 1. Mad Cow Disease                      | MSH 1                             |
|             | 2. Iowa Prairie for the 21st Century    | MSH 101                           |
|             | 3. Use of Student Data in Sci. Research | MSH 103                           |
| 5:00-6:00   | Sr. Academy Poster Viewing              | Union Expansion A & B             |
| 5:00-6:00   | Social Hour                             | Union Expansion A & B             |
| 6:00-7:30   | President's Banquet                     | Union Expansion A & B             |
| 8:00        | General Session II                      | MSH Lantz Auditorium              |

### Standing Committee Meeting Locations

| Committee Meeting                     | Room     |
|---------------------------------------|----------|
| Committee on Committees and Elections | MSH 126  |
| Conservation and Preserves            | MSH 277A |
| Finance Committee                     | MSH 1    |
| Student Programs Committee            | LAT 121  |
| Iowa Science Foundation Committee     | MSH 81B  |
| Membership Committee                  | MSH 245  |
| Recognition and Awards Committee      | MSH 103  |
| Societal Issues Committee             | MSH 1    |

# 2004 IAS ANNUAL MEETING

## POSTERS, BY SECTION

### ANTHROPOLOGY SECTION

2. TEOTIHUACÁN: AN INVESTIGATION OF BURIAL TRENDS IN TWO COMPOUNDS, Katie Casas
3. CORN: AN ASSESSMENT OF ITS NEEDS & WHERE THESE NEEDS CAN BEST BE MET WITHIN THE COCONINO NATIONAL FOREST, Sarah Davis
4. POINT HOPE, ALASKA IPIUTAK BURIALS: ARTIFACT AND WEALTH COMPARISON OF CARIBOU-HUNTING PEOPLE, Sarah Gossett
5. EXAMINING HEALTH IN PREHISTORIC ARIZONA: FROM MORTALITY TO PATHOLOGY, Rachel Sandler
6. SPACE SYNTAX ANALYSIS OF TUZIGOOT PUEBLO: A CASE STUDY FOR THE IMPLEMENTATION OF COMPUTERIZED SPACE SYNTAX ANALYSIS, Judd Swanson
7. PREDICTIVE MODELING: A STUDY OF PRE-HISPANIC COTTON CULTIVATION IN THE COCONINO NATIONAL FOREST, Betsy Vecchi

### BOTANY SECTION

9. USING FRUIT AND SEED MORPHOLOGY TO IDENTIFY *VITIS* HYBRIDS, Stacy Dubbert, Rachel Brincks, and J.M. Gerrath

### CELLULAR AND MOLECULAR BIOLOGY SECTION

16. NUMBER OF SECRETORY VESICLES IN GH CELLS OF THE PITUITARY REMAINS UNCHANGED AFTER SECRETION, J-S Lee, M.S. Mayes, M.H. Stromer<sup>1</sup>, B.P. Jena, and L.L Anderson
17. IDENTIFICATION OF YEAST GENES IMPORTANT FOR CHROMOSOME SEGREGATION IN MITOSIS, H. Sleister, S. Fatland, and S. Leeson
18. REGULATION OF *CANDIDA* CDR1: IMPLICATIONS FOR HEALTH, L. Vidal, J. Storm, M. Essmann, B. Larsen.
19. THE CLONING, SEQUENCING, AND CHARACTERIZATION OF CDNA(S) FROM *PECTINARIA GOULDII*, A. Watson, H. Edwards, D. Briggs, M. Dean, and T. Tauer

### CHEMISTRY: ORGANIC AND BIOLOGICAL SECTION

30. METABOLIC RESPONSES OF CONJUGATED TRIENE AND DIENE FATTY ACIDS IN GOLDEN SYRIAN HAMSTERS, M.M. Bohan, S. Zhang, A.L. McCleary, E. Hammond and D.C. Beitz
31. ANALYSIS OF THE MOLECULAR COMPONENTS OF THE CEMENT-LIKE SECRETION OF THE MARINE WORMS, *Pectinaria Gouldii* and *Phragmatopoma Lapidosa*, D. Briggs, H. Edwards, A. Watson, T. Tauer, and M. Dean

### CONSERVATION SECTION

34. RESPONSE OF BAILEY'S EASTERN WOODRAT (*NEOTOMA FLORIDANA BAILEYI*) TO A CONTROLLED FIRE MANAGEMENT REGIME, Ryan Brumm and Craig Hemsath
35. DOES MOWING REDUCE SOD DENSITY AND PROMOTE FORB RECRUITMENT IN A MATURE PRAIRIE RECONSTRUCTION, Amy L. Carolan, and Laura L. Jackson
36. CLASSIFICATION OF IOWA WETLANDS USING AN AIRBORNE HYPERSPECTRAL IMAGE: A COMPARISON OF SPECTRAL ANGLE MAPPER (SAM) CLASSIFIER AND AN OBJECT-ORIENTED (OO) APPROACH, James Harken and Ramanathan Sugumaran
37. CONTRASTING EFFECTS OF HABITAT QUANTITY AND QUALITY ON SPECIES DIVERSITY OF LEPIDOPTERA IN RESOTRED SAVANNAS, M. N. Lewis, R. M. Steichen, and K. S. Summerville

## 2004 IAS ANNUAL MEETING POSTERS, BY SECTION

### ENVIRONMENTAL SCIENCE AND HEALTH SECTION

60. PLACE BASED MONITORING IN ENVIRONMENTAL PROTECTION: A SAFE DRINKING WATER ACT CASE STUDY, Edwin Brands
61. DISTRIBUTION OF PESTICIDES IN IOWA RIVERS, Rebecca Hulse

### GEOLOGY SECTION

70. BASEMENT LITHOLOGY AND STRUCTURE FROM GRAVITY AND MAGNETIC DATA, NORTHEAST IOWA, Luke Aaron Johnson
71. LATE QUATERNARY EOLIAN SAND STRINGERS OF BREMER AND BLACK HAWK COUNTIES, NORTHEAST IOWA, J. Koch AND J. Walters
72. PRELIMINARY MAPS OF THE ST. PETER AND JORDAN FORMATIONS IN THE SUBSURFACE OF PORTIONS OF WINNESHIEK CO. IOWA, J.N. Young

### PHYSIOLOGY SECTION

81. EFFECT OF DATA SAMPLING RATE ON ACCURACY OF HEART RATE VARIABILITY INDICES, V. Bhatia and H.M. Stauss
82. CONTRIBUTION OF SYMPATHETIC NERVE ACTIVITY AND VASCULAR SYMPATHETIC RESPONSIVENESS TO SYMPATHETIC-MEDIATED BLOOD PRESSURE MAYER WAVES, A Gericke and H.M. Stauss
83. OXIDATIVE STRESS CONTRIBUTES TO INCREASED SYMPATHETIC VASOMOTOR TONE AND DECREASED BAROREFLEX SENSITIVITY IN HYPERTENSIVE AND HYPERCHOLESTEROLEMIC MICE, E. Lazartigues, C.A. Whiteis, N. Maheshwari, F.M. Abboud, H.M. Strauss, R.L. Davisson, and M.W. Chapleau
84. ACTIVITY-DEPENDENT "RESETTING" OF BARORECEPTOR AND VAGAL AFFERENT NEURONS MEDIATED BY HYDROGEN PEROXIDE/HYDROXYL RADICAL, V. Snitsarev, O. Yermolaieva, C.A. Whiteis, F.M. Abboud, and M.W. Chapleau

### SCIENCE TEACHING SECTION

85. iBENCH: INSTRUCTION IN BASIC EQUIPMENT NEEDED FOR CHEMISTRY & BIOLOGY, M. Dean, D. Fraga, W. Morgan, L. Stroschine, and T. Tauer

### ZOOLOGY SECTION

86. PREDATION AND ECOLOGY OF NESTING ORNATE BOX TURTLES, C.L. Barker, J.M. Wallace, J. Pisarik, J. Gohdes, Monica Goncze, N. Hennings, R.W. Black, S.A. McCollum, and N.P. Bernstein
87. POTENTIAL FISH HABITAT MATERIALS: A COMPARISON OF EFFECTIVENESS BASED ON INVERTEBRATE COLONIZATION, E.C. Cherko, T.W. Stewart, C.L. Pierce, and D.D. Stokke



## General Sessions

### General Session I - Neal Iverson

Friday - 11:00am, TBA

#### Slip Sliding Away: Probing the Physics of Glacier Motion beneath the Svartisen Ice Cap, Northern Norway

Tunnels in the bedrock beneath this ice cap provide unique access to the base of a thick (215 m), rapidly sliding glacier. Our measurements there indicate that current efforts to predict the speeds of sliding ice sheets neglect important processes, which need to be considered in large-scale models of ice-sheet behavior. In addition to our measurements, I'll discuss the challenges of living beneath the ice cap for extended periods.

Neal Iverson is an associate professor at Iowa State University and a native Iowan. He did his doctoral work at the University of Minnesota and was a senior research associate there before coming to Iowa State. His research focuses on processes that shape Earth's surface, with particular emphasis on glacier flow, erosion, and sediment transport. He has worked on and beneath glaciers in Scandinavia and the Canadian Rockies since 1983. Last year he received the Mid-Career Research Excellence Award from Iowa State's College of Liberal Arts and Sciences.



### General Session II - Barbara Freese

Friday - 8:00pm, McCollum Science Hall, Lantz Auditorium

#### Translation: Trying to Explain Scientific Concepts in a Nonscientific World

Freese's topic will draw on her experiences as an attorney and author who has tried to describe the science of climate change to her fellow nonscientists. She is one of the few people in the country to have actually litigated the subject of climate change, exploring this critical and complex scientific issue in the contentious setting of a courtroom for decision by nonscientist judges and policymakers. More recently, she explored the issue of climate change again -- this time for a general reading audience -- in her book, 'Coal: A Human History.'

Barbara Freese is the author of *Coal: A Human History*, published by Perseus Books in January 2003, and in paperback by Penguin in January 2004. Her critically-acclaimed book -- selected as a New York Times Notable Book for 2003 -- tells the story of how burning coal transformed human civilization. The book focuses on three nations in particular, the United States, Great Britain, and China, and addresses the social, economic, and environmental impacts of coal burning over the centuries. It also describes the impact of coal on America and the world today, especially the threat it

poses as a major cause of global warming.

An environmental attorney, Ms. Freese worked from 1986 to 1999 for the Minnesota Attorney General's Office. For most of that time she represented the Minnesota Pollution Control Agency, and focused particularly on implementing the Clean Air Act. Her particular interest in coal began with a legal case before the Minnesota Public Utilities Commission that took place in the mid-1990s. Known as the "Externalities Proceeding," it evolved into a lengthy administrative trial to determine the overall environmental costs of generating electricity, and came to focus largely on coal and climate change. The proceeding vividly illustrated coal's effect on the environment, and prompted Ms. Freese to dig more deeply into the subject. She is currently researching a new book about the emergence of the post-fossil-fuel world and works as an environmental attorney and consultant on energy and environmental matters. Ms. Freese, who lives in St. Paul, speaks around the nation on the subjects of coal and climate change.

### General Session III - Todd Heinrichs

Saturday - 11:00am, McCollum Science Hall, Lantz Auditorium

#### On Communicating Science: Stories from the Info Mesa and Beyond

Todd Heinrichs is a science writer and editor at Los Alamos National Laboratory. He has also worked as an editor in Detroit and at Michigan Technological University, where he earned his Masters in Rhetoric and Technical Communication. At Los Alamos, Todd has worked for the Environment, Safety, and Health training facility; the Environmental Restoration Project; and the Physics Division, where he has been for the last three years.



# Symposia Programs

## A. Mad Cow Disease

The honorable Patty Judge and a range of experts will explore the threat, the scare, and the implications of Mad Cow Disease to Iowans and Iowa's Economy.

### Speakers:

Dr. Mary Jo Schmerr, National Animal Disease Laboratory

Honorable Patty Judge, Secretary of Agriculture, Iowa Department of Agriculture and Land Stewardship

Dr. John Schiltz, State Veterinarian, Iowa Department of Agriculture and Land Stewardship

Dr. Edward P. Finnerty, Des Moines University, Department of Physiology/Pharmacology

## B. Iowa Prairie for the 21st Century: The Role of Native Seed

Interest in prairie reconstruction and restoration is increasing. Obtaining sufficient amounts of the correct seed is an important consideration. Activities and issues concerning native seed production in Iowa will be discussed.

### Introduction

Issues Involving Native Seed Use—Daryl Smith, Native Roadside Vegetation Center, University of Northern Iowa

### Native Seed Production

Iowa Ecotype Project—Greg Houseal, Native Roadside Vegetation Center, University of Northern Iowa

Mixed Harvest Production—Carl Kurtz, St. Anthony, Iowa

### Native Seed Certification

Source Identified Seed—Eileen Wuebker, Iowa Crop Improvement Association, Ames, Iowa

### Determining Relationships of Native Plant Populations

Genetic Analysis of Native Species—Jim Jurgenson, Biology Department, University of Northern Iowa

### Purchase and Use of Native Seed

Iowa DOT Roadside Plantings—Mark Masteller, Roadside Development, Iowa Department of Transportation, Ames

Pheasants Forever Habitat Plantings—Matt O'Connor, Pheasants Forever, Hopkinton, Iowa

## C. Use of Student Data in Scientific Research

Scientists from citizen monitoring programs, GLOBE and IOWATER will share examples of how observations made by K-12 students contribute to research. Discussion will include the benefits and limits of using students collected data.

### Introduction

Marcy Seavey, GLOBE ONE, Iowa Academy of Science

### The GLOBE Program

Dr. David Brooks, Principal Investigator for GLOBE's new Haze/Aerosols Project, Drexel University Philadelphia

Dr. Debra Krumm, Director of Outreach for NASA CloudSat Mission

### IOWATER

Brian Soenen, IOWATER, Iowa DNR

### Questions and Answer Session

**New! The Iowa Academy of Science Webstore!**

**[www.cafeshops.com/iasstore](http://www.cafeshops.com/iasstore)**

T-shirts, polo shirts, coffee cups and more! All items with logos from the Academy and its programs. Purchasing IAS logo items is easy and helps support IAS programs. More items coming soon! Visit today!

**Saturday Program Summary**  
**April 24<sup>th</sup>, 2004**

| Time        | Activity  | Location  |
|-------------|---|---|
| 8:00-12:00  | Registration                                    | MSH Ground Floor Lounge   |
| 8:00-11:00  | Section Meetings                                | See section meeting schedules<br>(pages 10-14) for specific schedules<br>and locations. |
| 8:00-12:00  | IAS Bookstore                                   | MSH 1 <sup>st</sup> Floor Lounge  |
| 8:00-11:00  | Continental Breakfast                           | MSH 1 <sup>st</sup> Floor Lounge  |
| 8:00-11:00  | NASA Missions (ISTS)                            | CEEE Rotunda  |
| 9:00-12:00  | Science Education Resource<br>Center Open House | CEEE 115  |
| 11:00-12:00 | General Session III                             | MSH Lantz Auditorium  |
| 12:00-1:30  | Lunch   | On Your Own   |
| 12:00-3:00  | Science Education Resource<br>Center Open House | CEEE 115  |
| 1:00-3:00   | Section Meetings                                | resume as necessary   |
| 1:00-3:00   | Native Roadside Vegetation<br>Center Open House | NRV, West 27th St.  |
| 2:30-5:00   | Geology Society of Iowa<br>Field Trip           | Entrance to LAT   |

**2004 IAS ANNUAL MEETING – SECTION MEETINGS**

**AGRICULTURAL SCIENCES SECTION (LATHAM HALL, ROOM 133)**  
(WITH ZOOLOGY SECTION, 9:00-10:30)

- 10:00 1. ASSESSING CONJUGATED LINOLEIC ACID (CLA) CONCENTRATIONS IN MILK FROM PASTURED DAIRY COWS, R.N. Sonon Jr., D.C. Beitz, A.H. Trenkle, and M.M. Bohan
- 10:15 Section Business Meeting

**ANTHROPOLOGY SECTION (LATHAM HALL, ROOM 125)**  
(With Geology and Chemistry Inorganic, 9:00-11:00)

- 10:00 8. THE EARLY YEARS: CHARLES R. KEYES'S ARCHAEOLOGICAL INQUIRIES, 1915-1921, Michael J. Perry
- 10:45 Section Business Meeting

## **BOTANY SECTION (LATHAM HALL, ROOM 101)**

- 8:00 10. A COMPARISON OF THREE TYPES OF TRICHOMES ON SOYBEAN (*Glycine max* L.) GYNOECIA OF THE CLARK NORMAL LINE AND SEVEN CLARK NEAR-ISOGENTIC LINES, R.A. Healy, H.T. Horner, T.B. Bailey, and R.G. Palmer
- 8:15 11. EVALUATION OF INSECT-MEDIATED SEED-SET AMONG SOYBEAN LINES WITH DIFFERENT ALLELES SEGREGATING FOR MALE STERILITY, E. Ortiz-Perez, I.G. Cervantes-Martinez, H.T. Horner, and R.G. Palmer
- 8:30 12. OXALATE DETERMINATION IN 96 LINES OF SOYBEAN (*Glycine max* L.), H.T. Horner, T. Cervantes-Martinez, R.A. Healy, T.B. Bailey, and R.G. Palmer
- 8:45 13. INITIATION AND PROGRESSION OF THE CALCIUM OXALATE PATTERN IN DEVELOPING *Prunus virginiana* (ROSACEAE) LEAVES, N.R. Lersten and H.T. Horner
- 9:00 14. INVENTORY, MAPPING AND QUALITY ASSESSMENT OF PRAIRIE REMNANTS IN RINGGOLD COUNTY, T.R. Rosburg
- 9:15 15. A QUANTITATIVE DESCRIPTION OF THE SEED BANK OF A DEGRADED PRAIRIE REMNANT, P.M. Lovell and T.R. Rosburg  
(Conservation Section in session in room 124)
- 10:30 Section Business Meeting

## **CELLULAR AND MOLECULAR BIOLOGY SECTION (McCOLLUM SCIENCE HALL, ROOM 101)**

- 8:00 20. WILL RED CEDAR EXTRACT INHIBIT GROWTH AND MOVEMENT IN CANCER CELLS?, Michelle Healy, Kavita R. Dhanwada, Darrell Weins and Kirk Manfredi
- 8:20 21. CATECHINS FROM GREEN TEA DECREASE GROWTH OF LEUKEMIC, BUT NOT NORMAL, T LYMPHOCYTES, L.A. Beltz and C. Andrews
- 8:40 22. CYTOKINE-INDUCED PHOSPHOINOSITIDE 3-KINASE ACTIVITY PROMOTES CDK2 ACTIVATION IN FACTOR-DEPENDENT HEMATOPOIETIC CELLS, M.K. Henry, D. Nimbalkar, R.J. Hohl, and F.W. Quelle
- 9:00 23. HYDROXYPHARNESYLPHOSPHONIC ACID INDUCES A G1 PHASE CELL CYCLE ARREST IN MOUSE MYELOID CELLS, C. Young and M.K. Henry
- 9:20 24. INFLUENCE OF PROTEIN GLYCOSYLATION ON CELL WALL SYNTHESIS IN YEAST, Martin Schmidt and Bryan Fritsch
- 9:40 25. IN VITRO DIFFERENTIATION OF THE FLAGELLATED PROTOZOAN, *Crithidia fasciculata*, Eric J. Scolaro, Ryan P. Ames, and Andrew Brittingham
- 10:00 26. APPENDAGES OF REPTILIAN MELANOMACROPHAGES; THE FIRST DOCUMENTATION OF STRUCTURE AND FUNCTION, S. Lovan, B.L. Bartels, L.C. Garvey, A.A. Miller, J.L. Christiansen, and J.C. Johnson
- 10:20 27. CABLEPODIA, A NEW FILAPOD-LIKE STRUCTURE TYPICAL OF MELANOMACROPHAGES, J.C. Johnson, S. Lovan, S.R. Nettikandan, S.G. Vengasandra, and J.L. Christiansen
- 10:40 Section Business Meeting

## **CHEMISTRY: INORGANIC, PHYSICAL, & ANALYTICAL SECTION (LATHAM HALL, ROOM 125)**

(With Anthropology and Geology, 9:00-11:00)

- 10:15 28. THE MOON AND THE ELECTRON MICROPROBE: CO-EVOLUTION OF AN ANALYTICAL METHOD AND ITS APPLICATION, Alfred Kracher
- 10:30 29. CHROMATOGRAPHIC IMMUNOASSAYS AND CHEMILUMINESCENCE DETECTION, W.S. Reiter and D.S. Hage
- 10:45 Section Business Meeting

**CHEMISTRY: ORGANIC AND BIOLOGICAL SECTION  
(McCOLLUM SCIENCE HALL, ROOM 266)**

10:00 Section Business Meeting

**COLLEGE SCIENCE TEACHING SECTION (McCOLLUM SCIENCE HALL, ROOM 43)**

9:00 32. CLASSROOM TESTING OF THE ATEEC CLIMATE CHANGE MODULE, J.L. Bonte

9:20 33. UNI PHYSICS INSTITUTE- A PROFESSIONAL DEVELOPMENT PROGRAM FOR OUT OF AREA HIGH SCHOOL PHYSICS TEACHERS, L.T. Escalada, J. Moeller, and A. Conley

9:40 Section Business Meeting

**COMMUNITY COLLEGE BIOLOGISTS SECTION  
(McCOLLUM SCIENCE HALL, ROOM 81B)**

10:00 Section Business Meeting

**CONSERVATION SECTION (LATHAM HALL, ROOM 124)**

9:00 38. BUILDING COMPREHENSIVE GEOSPATIAL MODELS OF AMPHIBIAN HABITATS IN YELLOWSTONE NATIONAL PARK, P.E. Bartelt, A.L. Gallant, and R.W. Klaver

9:15 39. RESPONSE OF BAILEY'S WOODRAT TO A FIRE MANAGEMENT REGIME, David A. McCullough

9:30 40. TOWARDS AN INVENTORY OF THE FUNGI OF IOWA PARKS AND PRESERVERS: A DATABASE OF RECORDS FROM MYCOLOGISTS PAST AND PRESENT, R. Healy, L. H. Tiffany, and L. McCormick

9:45 41. GENETIC VARIATION OF *SCHIZACHYRIUM SCOPARIUM* (LITTLE BLUESTEM) USING AFLP, Renae DeVries and James Jurgenson

10:00 42. GENETIC VARIATION OVER TWO GENERATIONS OF THE NATIVE PRAIRIE PLANTS: *PANCIUM VIRGATUM* AND *COREOPSIS PALMATE*, Faith Kruse and James Jurgenson

10:15 Section Business Meeting

**ENGINEERING SECTION (McCOLLUM SCIENCE HALL, ROOM 201)**

8:35 43. VIRTUAL SOLDIER RESEARCH AT THE UNIVERSITY OF IOWA, Karim A. Abdel-Malek

9:00 44. PERFORMANCE ANALYSIS OF A SCENE GRAPH IN COMPUTER GRAPHICS, Shailesh Kumar

9:20 45. DEFORMABLE SOLID MODELING USING NURBS-BASED FINITE ELEMENT METHOD, Xianlian Zhou and Jia Lu

9:40 46. SEPARATION AND RECOVERY OF UNBURNED CARBON FROM FLY ASH, J. T. Gorke and T. D. Wheelock

10:00 47. ENHANCING PRODUCER GAS HEATING VALUE USING A BALLASTED GASIFIER, S. S. Sadaka, J. L. Smeenk and R.C. Brown

10:20 48. A COMBINED CATALYST/SORBENT FOR PRODUCING HYDROGEN FROM HYDROCARBONS, J. A. Satrio, T. M. Diehl and B. C. Volmer

10:40 Section Business Meeting

1:00 49. WIND ENGINEERING AND EXPERIMENTAL AERODYNAMICS PROGRAM OF STUDY AT IOWA STATE UNIVERSITY, Partha P. Sarkar and Fred L. Haan

1:25 50. DETERMINATION OF AERODYNAMIC COEFFICIENTS OF A PARAFOIL USING THREE DIMENSIONAL MODELING AND EXPERIMENTAL VERIFICATION. , Joshua Bowman, Mike Cook, Colt Wallace, Greg Leavitt

1:45 51. BYPASS THROTTLING ON A SMALL WIND TUNNEL, Eric D. Muhle, Caleb A. Klein, and Dr. Daniel W. Black

2:05 52. REMOTE FIBER OPTIC HEALTH MONITORING: LOCAL AND GLOBAL EVALUATION OF A HIGH PERFORMANCE STEEL BRIDGE, J. D. Doornink, B. M. Phares, T. J. Wipf, L. F. Greimann, D. J. Hemphill

2:25 53. ROBUST CONTROL OF PNEUMATIC ACTIVE AUTOMOBILE SUSPENSION, H. Porumamilla and A. G. Kelkar

## ENGINEERING SECTION (Continued)

- 2:45 Break
- 2:50 54. ULTRASONIC MODELING AND SOME OF ITS APPLICATIONS AT THE CENTER FOR NDE, IOWA STATE UNIVERSITY, Lester W. Schmerr Jr.
- 3:15 55. A FINITE ELEMENT METHOD TO PREDICT THE ENERGY ABSORPTION IN A LONG FIBER COMPOSITE CRUSH TUBE, L. Pickett and V. Dayal
- 3:35 56. MECHANISMS INFLUENCING NET SECTION STRENGTH IN ALUMINUM FOAM, A. Antoniou, P.R. Onck and A.F. Bastawros
- 3:55 57. ABRASION STUDY OF NEW ULTRA-HARD  $\text{AlMgB}_{14}$  MATERIALS MODIFIED BY  $\text{TiB}_2$ , Atiq Ahmed and Shyam Bahadur
- 4:15 58. STRUCTURAL ANALYSIS AND OPTIMIZATION OF FLUID LOADED LAMINATED COMPOSITE CANARD, Yang Yang, Vinay Dayal, Jerry Vogel
- 4:35 59. COMPUTATIONAL NANO-MECHANICS: FROM MOLECULAR DYNAMICS TO MULTISCALE METHODS, S. P. Xiao
- 4:55 Paper Judging Panel and Award for Best Paper

## ENVIRONMENTAL SCIENCE AND HEALTH SECTION (McCOLLUM SCIENCE HALL, ROOM 103)

- 8:00 62. DETERMINING THE SOURCES OF FECAL POLLUTION TO SILVER LAKE, IOWA, Jacinta Uzoigwe and Ed Brown
- 8:15 63. FATE AND TRANSPORT OF PHOSPHATE THROUGH THE BEAVER VALLEY WETLANDS OF THE CEDAR RIVER WATERSHED, Renee Pasker, Ann Schwemm, Maureen Clayton and Ed Brown
- 8:30 64. EFFECTS OF INCREASED PHOSPHORUS INPUTS ON IOWA'S SURFACE WATERS, E.H. O'Brien, L.S. Seigley, M.P. Skopec
- 8:45 65. TMDL MONITORING PROTOCOLS AND ASSOCIATED FIELD COLLECTION ISSUES: THE IOWA PROGRAM, M.D. Schueller and M.A. Kruse
- 9:00 66. EFFECTS OF BEST MANAGEMENT PRACTICES ON WATER QUALITY IN SNY MAGILL CREEK, C.L. Fields
- 9:15 67. DOES ATRAZINE AFFECT THE CELL GROWTH OF HUMAN WHOLE EMBRYO CELLS?, Heather M. Krueger, Kavita R. Dhanwada
- 9:30 68. THE EFFECTS OF ATRAZINE AND ITS METABOLITES ON HUMAN CELL GROWTH FROM PESTICIDE CONTAMINATED IOWA WATER SOURCES, J.J. Becker, D.E. Bartak, M.E. Clayton and K.R. Dhanwada
- 9:45 69. MODELING AND MEASURING THE DISPERSION OF ODORS FROM HOG CONFINEMENTS, F. Bera and A.C. Czarnetzki
- 10:00 Section Business Meeting

## GEOLOGY SECTION (LATHAM HALL, ROOM 125)

- 9:00 73. PRELIMINARY GEOCHEMICAL ANALYSIS OF CORALS FROM THE NEOGENE GURABO FORMATION, DOMINICAN REPUBLIC, R.F. Denniston
- 9:15 74. THE INS AND OUTS OF THE CRETACEOUS DAKOTA FORMATION OF IOWA: FLUVIAL-ESTUARINE CYCLES OF THE KIOWA-SKULL CREEK MARINE TRANSGRESSION, G.A. Ludvigson, B.J. Witzke, T.S. White, and R.L. Brenner
- 9:30 75. PERMIAN-TRIASSIC BOUNDARY INTERVAL IN THE SOUTHERN ALPS (TESERO AND BULLA SECTIONS, NORTHERN ITALY), J.R. Groves, M.D. Boyce, B.J. Craig, and R. Rettori
- 9:45 76. COMPLETION OF THE DIGITAL MAPS OF THE BEDROCK GEOLOGY AND TOPOGRAPHY OF SOUTHWEST AND EAST-CENTRAL IOWA: PHASES 5 & 6 OF THE STATEMAP IOWA BEDROCK MAPPING PROGRAM, R.R. Anderson, B.J. Witzke, G.A. Ludvigson and B.J. Bunker
- 10:00 Anthropology Section and Chemistry: Inorganic, Physical, & Analytical Section Papers
- 10:45 Section Business Meeting

## **PHYSICS SECTION (McCOLLUM SCIENCE HALL, ROOM 215)**

- 9:00 77. PHYSICS OF POTASSIUM ION CHANNEL INACTIVATION IN NEURONS, R.M.W. Collins and C.C. Chancey  
9:15 78. USING EXCEL TO SIMULATE A GEIGER COUNTER, Thomas C. Gibbons  
9:30 79. VALUE ADDED! QUANTIFYING THE AMOUNT OF ENERGY SAVED BY RECYCLING, Patricia Higby and Zhong-Guang (Tony) Fang  
9:45 80. MODELING THE ACTIVATION OF MECHANISM OF POTASSIUM CHANNELS NEURONS, Kevin A. Twedt and C.C. Chancey  
10:00 Section Business Meeting

## **PHYSIOLOGY SECTION (McCOLLUM SCIENCE HALL, ROOM 126)**

- 10:00 Section Business Meeting

## **PSYCHOLOGY & LINGUISTICS SECTION (McCOLLUM SCIENCE HALL, ROOM 277A)**

- 10:00 Section Business Meeting

## **SCIENCE TEACHING SECTION**

K-12 Science Teaching Sections conduct business meetings at the ISTS Fall Conference.  
For more information, contact the current section chair.

## **ZOOLOGY SECTION (LATHAM HALL, ROOM 133)**

- 9:00 88. AGRICULTURAL PONDS SUPPORT AMPHIBIAN POPULATIONS, Melinda Knutson, William Richardson, David Reineke, Brian Gray, Jeffery Parmelee, Shawn Weick  
9:15 89. ECOLOGY OF THE EASTERN MASSASAUGA RATTLESNAKE IN IOWA, T.J. Van DeWalle  
9:30 90. TEMPERATURES OF WINTERING ORNATE BOX TURTLES, N.P. Bernstein and R.W. Black  
9:45 91. ESTIMATING AGE OF VERY OLD BOX TURTLES, B.P. Rinner, D. Courard-Hauri, and J.L. Christiansen  
10:00 Agricultural Science Section Paper  
10:15 Section Business Meeting

**Iowa Academy of Science  
2004 Awards**

The Iowa Academy of Science recognizes excellent in scientific research and science teaching.

The achievements of the following individuals will be celebrated at the President's Banquet:

**≈ Distinguished Iowa Scientist ≈**

Dr. Wendy Powers, Iowa State University

**≈ Distinguished Iowa Scientist ≈**

Dr. Arnold van der Valk, Iowa State University

**≈ Distinguished Service ≈**

Dr. Peggy Whitson, Johnson Space Center

**≈ Distinguished Fellow ≈**

Dr. Reid Palmer, Iowa State University

**≈ 2004 Excellence in Science Teaching Awards (ESTA) ≈**

The following teachers will be honored at the Awards Luncheon:

**Life Science**

Lori Ihrig - Williamsburg Jr./Sr. High School, Williamsburg

**Physical Science**

Jeff Siewert - Pella Community High School, Pella

**Middle/Junior High Science**

Doug Richardson - Norwalk Middle School, Norwalk



# 2004 IAS ANNUAL MEETING

## ABSTRACTS, BY SECTION

### AGRICULTURAL SCIENCES SECTION

#### ORAL PRESENTATION

#### 1. ASSESSING CONJUGATED LINOLEIC ACID (CLA) CONCENTRATIONS IN MILK FROM PASTURED DAIRY COWS

R.N. Sonon Jr., D.C. Beitz, A.H. Trenkle, and M.M. Bohan  
Nutritional Physiology Group, Department of Animal Science, Iowa State University, Ames, IA 50011-3150

An on-farm study was conducted to assess conjugated linoleic acid concentrations in milk throughout the year from cows among organic dairy farms in northeast Iowa and southwest Wisconsin where pasture grazing is a regular management practice. We hypothesized that cows allowed to graze intensively will produce milk with high CLA concentration. Twelve dairy farms participated in the study, and a monthly sampling of milk and feeds was undertaken from January 2002 to November 2003. Results showed that *cis9trans11* CLA concentration in milk was lowest during the first quarter and at the end of the year. The average CLA concentration in the milk during the first quarter of the year was 0.34 g/100 g of fatty acids and 0.33 g/100 g of fatty acids for northeast Iowa and southwest Wisconsin farms, respectively. The highest CLA concentration among the northeast Iowa farms was 1.42 g/100g of fatty acids, which was observed in the months of May and August. Among the southwest Wisconsin farms, the highest milk CLA concentration was 1.32 g/100 g of fatty acids, which was observed in the month of June. Concentration of CLA in the milk was increased by great intensity of grazing practice of the farm.

### ANTHROPOLOGY SECTION

#### POSTERS

#### 2. TEOTIHUACÁN: AN INVESTIGATION OF BURIAL TRENDS IN TWO COMPOUNDS

Katie Casas  
Grinnell College, Grinnell, IA 50112

Researches can learn a great deal about a population by studying their burials. The manner in which the body was prepared, whether it was buried with items or not, what those items were, and where the burials are located tells us much about the beliefs and practices of a society. This study focused on the examination of the variables of sex, phase and wealth in the burials of two compounds in the ancient city of Teotihuacán, Mexico. Several results were determined. Spatially, the burials were differentiated by phase but not by sex. The burials in the compound closer to the major sites of the city contained, on average, more artifacts than the compound farther from those sites and artifact rich burials were distributed randomly throughout the compounds. In the wealthier compound, male burials contained more artifacts than did female burials; this difference was not found in the less wealthy compound.

#### 3. CORN: AN ASSESSMENT OF ITS NEEDS & WHERE THESE NEEDS CAN BEST BE MET WITHIN THE COCONINO NATIONAL FOREST

Sarah Davis  
Grinnell College, Grinnell, IA 50112

For both prehistoric and modern man, corn has been a major subsistence crop. Civilizations have been founded on it and economies are dependent on it. There is ample evidence to suggest that corn has been growing in the American Southwest since prehistoric times, and more specifically, it has been cultivated in Northern Arizona since between 3000 and 2000 B.P. (Karen Adams, 1994). This research seeks to address where the populations living in what is now Arizona's Coconino National Forest would have been able to successfully cultivate corn in this harsh and variable landscape. This predictive model is based on the belief that their success was due to their keen sense of the environment and their ability to manipulate it, specifically by locating their fields in areas that receive adequate moisture, in areas with high herbaceous production potential and cinder cover, and on flat land near runoff channels. The model isolated approximately 2% of CNF land as optimal for growing corn.

#### 4. POINT HOPE, ALASKA IPIUTAK BURIALS: ARTIFACT AND WEALTH COMPARISON OF CARIBOU-HUNTING PEOPLE

Sarah Gossett  
Grinnell College, Grinnell, IA 50112

Among all vertebrates, only humans have treatments for the body after death. Burials are often the most complete source of artifacts and through analysis of mortuary practices anthropologists can study a vast number of things, including social ranking, spatial patterning, pathology, means of subsistence, and the spiritual and material culture of ancient peoples. The study of Point Hope burials revealed clustering that may be attributed to the placement of those with high social status.

Additional Copies of the Abstract Booklet  
may be purchased for \$5.00 from the Iowa  
Academy of Science Office

Contact Susan DeBord at:  
175 Baker Hall - UNI  
Cedar Falls, Iowa 50614  
(319)273-2021

## 5. EXAMINING HEALTH IN PREHISTORIC ARIZONA: FROM MORTALITY TO PATHOLOGY

Rachel Sandler

Grinnell College, Grinnell, IA 50112

Prehistoric health in Arizona was studied using skeletal pathologies that reflect nutritional status and disease and sub-adult mortality rates. Examining the spatial distribution of the health factors across the state can lead to a greater understanding of regional health and what factors may have contributed to the health status of the population. These data show that no real spatial pattern of health can be discerned at this time, which may have to do with the scarcity of sites with data collection that reflect burials examined for skeletal pathologies. In the future, a more thorough regional and temporal analysis should be done to further examine the health spatial patterns of the Southwest.

## 6. SPACE SYNTAX ANALYSIS OF TUZIGOOT PUEBLO: A CASE STUDY FOR THE IMPLEMENTATION OF COMPUTERIZED SPACE SYNTAX ANALYSIS

Judd Swanson

Grinnell College, Grinnell, IA 50112

Understanding the uses of space has been an important issue for archaeology for the entirety of the field's existence. Settlement layouts have been analyzed in the past for their contents and uses. Not until recently has the design of the settlement layout been analyzed as a separate and important entity using space syntax. Space syntax is a field of study concerned with the specific grammatical arrangement of space. It has been studied as a method of analysis, description, and, prediction of the human arrangement of space culturally, socially, and individually. When the developers of space syntax such as Hillier and Hanson first laid out in-depth methods for the analysis of space their ability to analyze it was limited by a lack of technology. Now with modern computer programs such as ArcMap and DepthMap we are finally able to apply some of these theories to practice. This project focuses on the analysis of the Tuzigoot site in the Verde Valley of Arizona as a case study for the implementation of computerized space syntax analysis. The goal of this study is to explore the validity and applicability of space syntax theories in southwestern pueblo sites.

## 7. PREDICTIVE MODELING: A STUDY OF PRE-HISPANIC COTTON CULTIVATION IN THE COCONINO NATIONAL FOREST

Betsy Vecchi

Grinnell College, Grinnell, IA 50112

Cotton was cultivated in the pre-Hispanic Southwest. Evidence of its production has been found in the Coconino National Forest in the form of seeds, fibers, and spinning tools. To determine where cotton where cotton might have been grown, a number of variables were used to make a

predictive model in GIS (Geographic Information Systems). Bases on this model, the ideal zones for cotton cultivation in the CNF are adjacent to the central mountainous zones.

## ORAL PRESENTATION

### 8. THE EARLY YEARS: CHARLES R. KEYES'S ARCHAEOLOGICAL INQUIRIES, 1915-1921

Michael J. Perry

University of Iowa, Office of the State Archaeologist

A booklet of field notes describing Charles R. Keyes's archaeological activities during the years of 1915-1921 was overlooked during the past analyses of his large collection of Iowa Archeological Survey records and artifacts. The booklet presents descriptions of eastern Iowa artifact collections examined from 1915-1920, and a daily journal of Keyes's summer of 1921 trip to the Iowa Great Lakes region. The pre-1921 entries represent sporadic, occasionally undated, inquiries into private collections, but do not describe personal site visits. The Iowa Great Lakes journal is an important source of primary field data on 18 archeological sites including five previously unrecorded manifestations. Keyes's survey of the Milford site, a large but poorly understood proto-historic Oneota occupation, provides significant information regarding the location of mounds, occupational areas, and previously unknown earthworks. His notation style parallels that of his better-known county notes amassed during his tenure as director of the survey, suggesting that the Iowa Great Lakes trip was a springboard to his 1922 appointment.

## BOTANY SECTION

### POSTER

### 9. USING FRUIT AND SEED MORPHOLOGY TO IDENTIFY *VITIS* HYBRIDS

Stacy Dubbert, Rachel Brincks, and J.M. Gerrath

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

A recent resurgence in the Iowa grape industry has revealed that in the scramble to expand, growers did not always obtain certified plant material. As a result, on average 1-5% of all vines planted in the state are misidentified. Currently there are no resources available for identifying the modern hybrid grape varieties being grown in the Midwest. Our long range goal is to develop a handbook with synoptic keys for identification of these varieties.

Literature from the 19<sup>th</sup> century showed that seed characters could be used to identify North American wild grape species. The objective of this study was to apply this protocol to identify hybrid grape varieties. Fruits and seeds of seven commercially available varieties of grape were examined. Results showed that when pericarp color is combined with seed color and raphe, hilum and chalaza characters, each variety can be easily identified. Thus, we will include seed characters in combination with leaf, flower, and cane characters when producing our handbook.

## ORAL PRESENTATIONS

### 10. A COMPARISON OF THREE TYPES OF TRICHOMES ON SOYBEAN (*Glycine max* L.) GYNOECIA OF THE CLARK NORMAL LINE AND SEVEN CLARK NEAR-ISOGENIC LINES

R.A. Healy, H.T. Horner, T.B. Bailey, and R.G. Palmer  
Iowa State University and USDA-ARS CICGR, Ames, IA 50011

It is of interest to identify floral traits that will enhance attraction of pollinators in order to produce hybrid soybeans. Two traits of potential interest are type and number of trichomes on the gynoecium. We studied three types of trichomes on the gynoecia of normal Clark line and how they differed in morphology, number, and distribution, from the gynoecia of a tetraploid line, and seven near-isogenic lines that included glabrous, puberulent, sparse, sharp-tipped, dense-1, dense-2 and double dense.

The normal lines has long thin-walled unicellular trichomes and short, 5-10-celled secretory trichomes mostly covering the central portion of the gynoecia. Long, thick-walled trichomes are generally concentrated on the dorsal side of the gynoecia and extend part way up the style. The three types are present in all lines except for glabrous, which is missing thick-walled trichomes. Secretory trichomes vary least in number and morphology, whereas unicellular trichomes vary most in number. Thick-walled trichomes vary most in distribution along the gynoecium.

### 11. EVALUATION OF INSECT-MEDIATED SEED-SET AMONG SOYBEAN LINES WITH DIFFERENT ALLELES SEGREGATING FOR MALE STERILITY

E. Ortiz-Perez, I.G. Cervantes-Martinez, H.T. Horner, and R.G. Palmer  
Iowa State University and USDA-ARS CICGR, Ames, IA 50011

Currently an economical way of producing F<sub>1</sub> hybrid soybean seed in the USA is not available. The most challenging barrier is the efficient transfer of pollen from the male parent to the male-sterile, female-fertile parent. This barrier can be overcome through pollinator insects. Information about the traits that influence pollinator preferences or attraction to soybean flowers is unknown. Our hypothesis is that seed-set on male-sterile, female-fertile plants is a direct indicator of pollinator attraction. The objective of this study was to evaluate seed-set among different male-sterile, female-fertile soybean lines using the *Megachile* sp. as pollinator.

Thirty-four pairs of near-isogenic lines segregating for male sterility (*ms6*) and a group of mutants segregating for male sterility (*ms1*) to (*ms9*) were field grown and seed-set was evaluated in 2001, 2002, and 2003 at Ames. Our results indicate that there are significant differences in seed-set within the near-isogenic lines, the male-sterile (*ms1*) to male-sterile (*ms9*) lines, and between the two groups, suggesting preferential attraction of the bee pollinators.

Selection among male-sterile, female-fertile lines can be conducted in order to obtain hybrid soybean seed. The seed-set was not high enough for commercialization, but current research is being conducted on promising male-sterile, female-fertile lines and insect pollinators at other geographical locations away from Ames.

### 12. OXALATE DETERMINATION IN 96 LINES OF SOYBEAN (*Glycine max* L.)

H.T. Horner, T. Cervantes-Martinez, R.A. Healy, T.B. Bailey, and R.G. Palmer  
Iowa State University and USDA-ARS CICGR, Ames 50011

Seeds from 96 lines of soybean were analyzed for oxalate (Ox) using a procedure from SIGMA<sup>®</sup> urinalysis kit modified to use with plant tissues, and to determine what are the Ox levels in soybeans as a basis for use in preparing soy foods.

The procedure involves grinding seeds into fine powders and testing them for total, insoluble and soluble Ox. Ox levels are determined from enzyme/colorimetric reactions read on a spectrophotometer. The data show the range of total Ox among 96 lines is from 82-223 mg Ox/100 g powder. In a published study that tested intake of seven commercial soy products, Ox content ranged from 12-172 mg Ox/serving. Foods containing 10 mg of Ox/serving are considered high-Ox foods. Normal urinary excretion is between 10-39 mg/day. Intake of soy foods high in Ox would increase this level to above 40 mg/day, a condition called hyperoxaluria that may lead to kidney stone formation. These results indicate that different soybean lines have a range of Ox that could be a problem in consumption of soy foods by individuals prone to kidney stones. Proper choice of low-Ox lines would help to alleviate this potential condition.

### 13. INITIATION AND PROGRESSION OF THE CALCIUM OXALATE PATTERN IN DEVELOPING *Prunus virginiana* (ROSACEAE) LEAVES

N.R. Lersten and H.T. Horner  
Iowa State University, Ames 50011

Bleached leaves viewed microscopically in whole mounts with polarized light has allowed us to describe progressive crystal formation in a leaf for the first time. *Prunus virginiana* (choke-cherry) stems have only druses (spherical aggregate crystals). Bud scales have only prismatic (cuboidal single crystals). Crystals appear first as an apical cluster of prismatic in stipules 100 µm long next to leaf primordia; next, a similar prismatic cluster appears at the apex of 500 µm long leaf primordium. Prismatic then advance basipetally in the growing stipules and, as a petiole forms, druses advance into it from the stem. In a 1.1 to 1.5 cm long leaf, tiny prismatic appear scattered throughout the palisade mesophyll; the crystals grow, and new ones are initiated, as the leaf lamina expands. Meanwhile, in a leaf 2 to 4 cm long, druses reach the petiole apex and begin to

expand into the blade along the midvein; by 4 to 5 cm, druses approach the midvein tip, and also enter lower main lateral veins. From 5 to 10 cm (max. length) in mid-May, a few additional druses form in small orders of veins. Full-sized leaves, from May to September, continue prismatic growth in mesophyll cells. Druses appear in most vein orders after leaf maturity, many becoming quite large with conspicuous cores. Just-shed and overwintered leaves retain all crystals.

#### **14. INVENTORY, MAPPING AND QUALITY ASSESSMENT OF PRAIRIE REMNANTS IN RINGGOLD COUNTY**

T.R. Rosburg

Department of Biology, Drake University, 2507 Univ. Ave., Des Moines, IA

The Grand River Grasslands project is a cooperative effort among the Iowa Department of Natural Resources, Missouri Department of Conservation and The Nature Conservancy to restore a functional tallgrass prairie ecosystem along the Iowa and Missouri border. This research was implemented to support this goal by mapping and assessing quality of prairie remnants in the southeastern portion of Ringgold County. Aerial color-infrared photographs were utilized as maps for the conducting field surveys, which focused on about 19,000 acres of pasture and CRP land. Prairie remnants were defined as communities that contained at least five prairie plant indicator species. Single species populations of prairie indicators were mapped as prairie elements.

The field survey identified 115 prairie remnants ranging in size from 0.05 to 15 acres. The remnants encompassed about 135 acres, or 0.4% of the project area. Persistence of remnants was most often associated with fence line or field edges, followed by poor accessibility and low soil fertility. Land use of the surrounding land was CRP for 60% of the remnants. Grazed pasture was the second most common land use (13%). Most of the remnants were rated a D in quality; A and B remnants accounted for only 2% and 9.5% respectively. A total of 83 prairie indicator species were observed, the most common of these were *Sporobolus asper*, *Pycnanthemum tenuifolium*, *Andropogon gerardii*, and *Ratibida pinnata*. A total of 3,125 prairie elements were mapped representing 55 prairie plant species.

#### **15. A QUANTITATIVE DESCRIPTION OF THE SEED BANK OF A DEGRADED PRAIRIE REMNANT**

P.M. Lovell and T.R. Rosburg

Department of Biology, Drake University, 2507 Univ. Ave., Des Moines, IA

The seed bank of Van Oel prairie, a degraded remnant in northeast Polk County, was investigated with field and greenhouse studies from March 2001 to November 2002. Two objectives were to 1) provide a description of the community composition of the seed bank and 2) ascertain effects of seed depth (0-3 cm vs. 3-6 cm) and time of

sampling (spring vs. fall) on the germination of seeds present in the seed bank. Soil cores representing the two depths were collected from 10 plots on the remnant in April and September. All samples were processed after the September samples and a greenhouse seedling assay was used to identify and count seeds.

A total of 2,112 seedlings were observed, 64% were from the April sample and 36% were collected in September. Nearly 70% of the seedlings were in the 0-3 cm depth, while 30% were in the 3-6 cm depth. At least 63 species were identified, the five most abundant included *Conyza canadensis*, *Juncus* sp., *Poa pratensis*, *Oxalis stricta*, and *Aster pilosus*. Among the prairie species observed in the vegetation, only *Monarda fistulosa* and *Helianthus tuberosa* were identified in the seed bank. An additional prairie species observed in the seed bank, *Rudbeckia hirta*, was not present in the vegetation. A species new for Iowa, *Geranium dissectum*, was discovered. Several plant species exhibited specific and significant effects of either plot, depth, or time on the abundance of seeds in the seed bank.

#### **CELLULAR AND MOLECULAR BIOLOGY SECTION POSTERS**

##### **16. NUMBER OF SECRETORY VESICLES IN GH CELLS OF THE PITUITARY REMAINS UNCHANGED AFTER SECRETION**

J-S Lee<sup>1</sup>, M.S. Mayes<sup>1</sup>, M.H. Stromer<sup>1</sup>, B.P. Jena<sup>3</sup>, and L.L. Anderson<sup>1,2</sup>

<sup>1</sup>Department of Animal Science, <sup>2</sup>Department of Biomedical Sciences, Iowa State University, Ames, IA 50011, <sup>3</sup>Department of Physiology, Wayne State University School of Medicine, Detroit, MI 48201

Recent studies reveal that there is no change in total number of secretory vesicles after exocytosis, where as there is an increase in number of empty and partly empty vesicles in a variety of secretory cells. Transmission electron microscopy (TEM) was used to determine the total number of all categories of secretory vesicles in resting and in growth hormone secretagogue (GHS)-stimulated porcine pituitary GH cells. We identified three categories of vesicles; filled, empty, and partly empty. Control pituitary cells contained more than twice as many filled vesicles than did the stimulated cells. However, stimulated cell contained nearly twice as many empty vesicles and 2.5 x more partly empty vesicles than did control cells. There was no significant difference in total number of vesicles between control and stimulated pituitary cells. Each category of vesicles on a  $\mu\text{m}^2$  of cell area basis, and was determined independently by two persons. Our results extended those from earlier studies on other cell types, consistent with a mechanism that following stimulation vesicles transiently dock and fuse at the fusion pore to release vesicular contents. The empty vesicles seem to be then recycled. Supported by grants from NIH (BPJ), USDA NRI (LLA), Hatch Act and State of Iowa funds.

## 17. IDENTIFICATION OF YEAST GENES IMPORTANT FOR CHROMOSOME SEGREGATION IN MITOSIS

H. Sleister, S. Fatland, and S. Leeson

Drake University, 2507 University Ave., Des Moines, IA 50311

The cell cycle is a highly regulated process that involves alternating phases of cell growth and cell division. In order for chromosomes to be transmitted to progeny cells with high fidelity during cell division, chromosomes must be fully replicated prior to mitosis and accurately segregated during mitosis. A genetically tractable organism for analysis of chromosome transmission is the common baker's yeast *Saccharomyces cerevisiae*. To identify genes important for chromosome transmission, yeast cells containing a genetically-marked yeast artificial chromosome (YAC) were mutagenized with ultraviolet light. This resulted in the isolation of 132 YAC stability in mitosis (*ysm*) mutants. In addition to genetic characterization of these mutants, subsets of the *ysm*'s were analyzed for YAC loss rate, sporulation efficiency, and sensitivity to hydroxyurea, methyl methanesulfonate, and ultraviolet light. The results elucidated mutant phenotypes that will facilitate cloning the wild-type genes that are altered in these mutants, allowing for identification of genes important for chromosome segregation as well as for DNA replication, DNA repair, and microtubule function. Because many processes and characteristics of higher organisms (including humans) are conserved in yeast (e.g., cell growth and division, DNA replication, DNA repair, signal transduction pathways, and cytoskeleton organization), information learned in this study may be applicable to humans.

## 18. REGULATION OF *CANDIDA* CDR1: IMPLICATIONS FOR HEALTH

L. Vidal, J. Storm, M. Essmann, B. Larsen.

Des Moines University, 3200 Grant Avenue, Des Moines, IA 50312

Microbial pathogens are known to undergo physiologic adaptations in response to environmental cues. For the yeast, *Candida albicans*, one such sensing system is detection of estrogen in the environment which may induce activity of an ABC-cassette efflux pump encoded by CDR1. This pump attenuates the organism's susceptibility to antifungal drugs. In addition, we postulate that CDR1 expression could serve as a detection system for environmental estrogens.

We tested nearly 80 strains of *Candida* from our culture collection for responses to estradiol in chemically-defined growth media and 50 were stimulated by estradiol. When diethylstilbestrol was added to the media, growth stimulation was also noted suggesting that non-steroidal estrogens might be detectable by *Candida* responses. This response appeared to be limited to those strains originally responsive to estradiol.

An RT-PCR based test was applied to estrogen stimulated and control *Candida* and showed up-regulation of CDR1 in the presence of estradiol. Some strains showed decreased susceptibility to antifungal compounds when estradiol was added to the medium, presumably due to increased efflux pump activity. This system is envisioned to have utility in testing non-steroidal estrogens and environmental samples for their ability to increase CDR expression.

## 19. THE CLONING, SEQUENCING, AND CHARACTERIZATION OF CDNA(S) FROM *PECTINARIA GOULDII*

A. Watson, H. Edwards, D. Briggs, M. Dean<sup>2</sup>, and T. Tauer<sup>1</sup>

<sup>1</sup>Department of Biology, <sup>2</sup>Department of Chemistry, Coe College, 1220 1st Ave., NE, Cedar Rapids, IA 52402

*Pectinaria gouldii*, commonly known as the trumpet worm or ice-cream cone worm, is the only benthic marine annelid that can be found in the eastern United States. The animal constructs a cone-shaped tube made of sand, in which it lives. Sand grains from its surroundings are moved to the mouth, swallowed, and organic material adhering to them removed and digested. The worm selects some of these sand grains and secures them into place with a cement-like protein found in its saliva.

In order to better understand the organism and its ability to make this cement-like protein, we extracted total RNA from living worms, purified the mRNA, converted it to cDNA, and cloned the cDNA into a plasmid vector. The recombinant plasmids were then used to transform *E. coli* to complete the cDNA library. Some of the recombinant plasmids were purified and used as a template source for amplifying *P. gouldii* cDNA via polymerase chain reaction. The amplified cDNA was purified and subjected to automated DNA sequencing. We report three cDNA sequences (one unique, one coding for ribosomal protein L7, and one coding for cytochrome c) analyzed via bioinformatics software and published to GenBank.

## ORAL PRESENTATIONS

### 20. WILL RED CEDAR EXTRACT INHIBIT GROWTH AND MOVEMENT IN CANCER CELLS?

Michelle Healy, Kavita R. Dhanwada, Darrell Weins and Kirk Manfredi

University of Northern Iowa, Cedar Falls, IA 50613

Native Americans have traditionally used *Juniperus virginiana* to treat a wide variety of ailments, but we specifically tested an extract of this plant to determine its effects on tumorigenic cell growth and movement. Using a growth assay, we assessed the effects of the extract on the proliferation of CaSki cells, a metastatic epithelial human cell line. Growth of the cells was inhibited by the extract, but the effect was not characteristically dose-dependent. To test the extract's effects on cell motility, we made time-lapse microscopic image sequences of the cultured cells and compared the differences in morphological and motility characteristics shown after treatment with increasing

concentrations of the extract. Treated cells were less flattened, reduced in area, and inhibited in dynamic area change behavior. These observations show that the extract from *Juniperus virginiana* contains some compound(s) that significantly inhibit cell growth and movement in cancerous cells. This research was supported by a grant from Merck/AAAS Foundation.

## 21. CATECHINS FROM GREEN TEA DECREASE GROWTH OF LEUKEMIC, BUT NOT NORMAL, T LYMPHOCYTES

L.A. Beltz and C. Andrews

University of Northern Iowa, Cedar Falls, IA 50614

Green tea extracts decrease growth of several kinds of cancer cells in vitro, and drinking 10 Japanese-size cups of tea per day reduces risks of developing cancer. The main catechins in tea are epicatechin (EC), epigallocatechin (EGC), epicatechin gallate (ECG), and epigallocatechin gallate (EGCG).

EGCG (30  $\mu$ M) suppressed Jurkat human leukemic T lymphocyte growth by 64% while suppression by EGC was 25%, by ECG was 18%, and EC was not suppressive. Importantly, 30  $\mu$ M catechins did not decrease normal blood T lymphocytes growth. Growth inhibition of leukemic cells by EGCG was significant at 48-96, but not at 24, hrs. Next, green and black tea extracts were prepared by adding 1g of tea to 100 ml of 100°C water for 30'. This extract was added to powdered RPMI 1640 media and used for cell culture. Leukemic cell growth was decreased 62% by 2.5% green tea extract and 47% by black tea. Little growth suppression was seen when tea extracts were added to normal T lymphocytes, but interleukin-2 production increased while interleukin-10 production decreased in a dose-dependent manner, suggesting that tea extracts promote a Th1-type of response.

## 22. CYTOKINE-INDUCED PHOSPHOINOSITIDE 3-KINASE ACTIVITY PROMOTES CDK2 ACTIVATION IN FACTOR-DEPENDENT HEMATOPOIETIC CELLS

M.K. Henry<sup>1</sup>, D. Nimbalkar<sup>2</sup>, R.J. Hohl<sup>2</sup>, and F.W. Quelle<sup>2</sup>

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Cytokine growth factors regulate the proliferation of hematopoietic cells through activation of several distinct signaling pathways. We have assessed the contribution of phosphoinositide 3-kinase (PI3K) pathways to erythropoietin (Epo) and interleukin (IL)-3 induced proliferation of factor-dependent hematopoietic cells. Lack of cytokine-induced PI3K activation caused by receptor mutation or treatment with a specific inhibitor (LY294002) did not prevent proliferation, but resulted in an increase in the G1 phase content and doubling time of cell cultures. The reduced proliferation in cells lacking cytokine-induced PI3K activity could be partially restored by overexpression of constitutively active Akt. Inhibition of PI3K activity

decreased the proportion of cytokine-treated cells entering S phase, and was associated with a significant reduction in cytokine-induced phosphorylation and activation of Cdk2. By contrast, Cdk4 activity and p27<sup>Kip1</sup> expression were not significantly altered by inhibition of PI3K. Together, these observations identify a mechanism through which cytokine-activated PI3K contributes to G1 to S phase progression in factor-dependent hematopoietic cells by enhancing the phosphorylation and activation of Cdk2.

## 23. HYDROXYFARNESYLPHOSPHONIC ACID INDUCES A G1 PHASE CELL CYCLE ARREST IN MOUSE MYELOID CELLS

C. Young<sup>1,2</sup> and M.K. Henry<sup>2</sup>

<sup>1</sup>Drake University, 2507 University Ave. Des Moines, IA 50311; <sup>2</sup>Des Moines University, 3200 Grand Ave, Des Moines, IA 50312

Protein prenylation is a post translational modification that results in the addition of farnesyl (15 carbon chain) or geranylgeranyl (20 carbon chain) group to the carboxy terminus of many proteins, such as Ras family members. This post translational modification is required for targeting proteins to the proper subcellular location as well as protein function. Inhibition of protein prenylation results in a wide variety of cellular responses such as apoptosis and cell cycle arrest. 32D cells are a cytokine-dependent mouse myeloid cell line that requires cytokines such as interleukin (IL)-3 or erythropoietin (Epo) for survival and proliferation. 32D cells treated with the farnesyl transferase inhibitor, hydroxyfarnesylphosphonic acid (HFPA) impairs Epo-mediated cell growth, resulting in a G1 phase cell cycle arrest. This arrest occurs within 16 hours following administration of HFPA to 32D cell cultures. Since many signaling pathways activated by Epo in 32D cells regulate growth, we are attempting to define any cytokine-activated pathways that are not impaired by HFPA treatment. To date, it appears that HFPA does not interfere with Epo-activation of Stat5 or MAPK pathways. Additionally, we are attempting to identify deficiencies following HFPA treatment in cell cycle regulators that mediate the transition from G1 to S phase. Here we report a novel effect of the farnesyl transferase inhibitor HFPA on myeloid cell growth and are initiating studies to characterize the HFPA-induced growth arrest.

## 24. INFLUENCE OF PROTEIN GLYCOSYLATION ON CELL WALL SYNTHESIS IN YEAST

Martin Schmidt and Bryan Fritsch

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We performed a genetic screen to identify proteins that are necessary for cell wall synthesis during cytokinesis in yeast. The screen identified mutants that rely on elevated chitin synthesis for survival. We isolated two mutations that caused defects in cytokinesis and cell wall synthesis, *mmn9* and *mmn10*. Both genes encode mannosyltransferases, necessary for the N-linked glycosylation of proteins.

How does a defect in protein glycosylation affect cell wall synthesis? The yeast cell wall consists of  $\beta(1,3)$ glucan,  $\beta(1,6)$ glucan, chitin and a major fraction of mannosylated proteins. A previous study proposes that a defect in protein mannosylation destabilizes the cell wall by affecting the abundance of mannosylated proteins and makes cells dependent on elevated chitin synthesis. Our data suggest that a mannosylation defect directly affects cytokinesis, which makes cells dependent on elevated chitin synthesis for the formation of remedial septa.

At cytokinesis, a primary septum is constructed to separate mother and daughter cells which consists entirely of chitin. The enzymatic activity that is responsible for the synthesis of the primary septum is subject to tight control. The catalytic moiety of this enzyme activity is predicted to be glycosylated. We present evidence that the defect in protein glycosylation upsets this septum-forming enzyme activity. It can be speculated that other cell wall-synthesizing enzymes – all predicted to be glycosylated – are influenced in a similar way by mannosyltransferase defects.

## 25. IN VITRO DIFFERENTIATION OF THE FLAGELLATED PROTOZOAN *Crithidia fasciculata*

Eric J. Scolaro<sup>1</sup>, Ryan P. Ames<sup>1</sup>, and Andrew Brittingham<sup>2</sup>.  
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*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 more elongated form swimming freely in the gut lumen. We have developed an *in vitro* culture which reproduces the appearance of these two distinct morphological forms. Using two different cultivation methods, shaking and stationary incubations, we have demonstrated a growth phase regulated adherence phenotype. Organisms in the logarithmic phase of growth possess the ability to adhere to substrates; this ability is lost when the organism enters a stationary growth phase. Furthermore, we have identified two molecular markers of *Crithidia* differentiation. Two surface glycoproteins, gp63 and gp46, vary in abundance and appearance as organisms differentiate from attached to swimming forms. A role for these two proteins, and other surface proteins, in the attachment of *Crithidia* to substrates is currently under investigation. Results of these studies will not only provide information on the cellular and molecular biology of *Crithidia*, but also other closely related protozoan parasites (*Leishmania* and *Trypanosoma*), which cause diseases of man and animals.

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## 26. APPENDAGES OF REPTILIAN MELANOMACROPHAGES; THE FIRST DOCUMENTATION OF STRUCTURE AND FUNCTION

S. Lovan<sup>1</sup>, B.L. Bartels<sup>1</sup>, L.C. Garvey<sup>1</sup>, A.A. Miller<sup>1</sup>, J.L. Christiansen<sup>1</sup>, and J.C. Johnson<sup>2</sup>

<sup>1</sup>Biology Dept., Drake University, and <sup>2</sup>Dept. Microbiology, Des Moines Univ. Des Moines, IA

Melanomacrophages are melanin-producing phagocytic cells found in the liver, spleen, and other organs of turtles and other cold-blooded vertebrates. Cultures of these cells have elucidated functions of cellular processes and have suggested reasons for the aggregations these cells form. We describe specialized filapodia connecting MMs to other MMs and to other conspecific cells but usually not to non-conspecific cells. We suggest that the network of interconnections may serve to trap foreign agents moving through the sinusoids and may have other specific functions in communication and cell control. At the ends of filapodia are often fan-like structures that have been observed in functions of engulfment of particulate materials. We provide evidence of transfer of materials from one cell to another through filapodia and that they sometimes expel melanin and other materials from the cells. MMs use lamellapodia to phagocytize large materials such as erythrocytes. Our analyses and observation of intercellular clearing suggest that filapodia and lamellapodia may excrete proteases. These observations suggest a large number of complex intercellular functions that could be disrupted in microgravity and should be tested as a potential standard for the impact of microgravity on cellular function. We thank the Iowa Space Grant Consortium for supporting this research.

## 27. CABLEPODIA, A NEW FILAPOD-LIKE STRUCTURE TYPICAL OF MELANOMACROPHAGES

J.C. Johnson<sup>1</sup>, S. Lovan<sup>2</sup>, S.R. Nettikandan<sup>3</sup>, S.G. Vengasandra<sup>3</sup>, and J.L. Christiansen<sup>2</sup>

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Cablepodia are previously undescribed cellular processes resembling invadopodia, a class of filopodia, described for facilitating glioma cell invasion. They differ from those processes in that they have multiple functions apparently to the exclusion of participation in an invasion function. The most evident function is attachment to conspecific cells for purposes of communication, and possibly, as with filapodia for entrapment of foreign cells moving through hepatic sinusoids. They are long (to 900 micrometers), narrow (to 520 nm), straight or with occasional angular bends depending on cell contact, unbranched unlike neurites, and under *in vitro* conditions will extend from a cell membrane at a rate of 110 micrometers per day.

While extending, the developing cable terminates in a small bulb. When cablepodia terminate on other cells they attach

with a distinct foot process. This process spreads over the surface of the cell and anchors with filaments less than 2 nm wide. As with filopodia, material can be seen changing position within the cable. The process may also be used in engulfment of foreign cells or materials. Cablepodia seem to be involved with cell recognition and identification. Tracking these dynamic, delicate structures under microgravity should produce a sensitive measure of microgravity effects on cell function.

## **CHEMISTRY: INORGANIC, PHYSICAL, & ANALYTICAL SECTION**

### **ORAL PRESENTATIONS**

#### **28. THE MOON AND THE ELECTRON MICROPROBE: CO-EVOLUTION OF AN ANALYTICAL METHOD AND ITS APPLICATION**

Alfred Kracher

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Electron probe microanalysis (EPMA) is a mature method of determining the elemental composition of solid samples which today is widely used in geology, materials science, chemistry, and other fields. Its principles were first proposed in 1949 by Raymond Castaing. The major driving force for developing the principle into a useful routine method of chemical analysis came from the study of extraterrestrial samples: cosmic spherules, meteorites, and after 1969 lunar rocks. The fact that these samples are by nature rare and often unique called for the ability to work on small samples that would not be consumed by the analytical process. For several decades a "co-evolution" of the analytical method and the progress in sample studies took place.

Today a wide range of applications exists for EPMA. The work on advanced materials at Ames Laboratory would be unthinkable without high quality methods of sample characterization, including EPMA. Extraterrestrial sample analysis continues to drive the development and refinement of analytical methods, such as high resolution inductively coupled plasma mass spectrometry (HR-ICP-MS) and secondary ion mass spectrometry (SIMS). Some method development is driven by NASA sample return missions such as *Genesis* and *Stardust*. Sample sizes are exceedingly small, pushing methodical limits. As we have learned from the history of EPMA, extraterrestrial sample research can play a major role in the development and refinement of analytical methods, and is likely to do so in the future. In this context it is important to encourage wide participation in sample return missions by the scientific community.

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## **29. CHROMATOGRAPHIC IMMUNOASSAYS AND CHEMILUMINESCENCE DETECTION**

W.S. Reiter and D.S. Hage

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University of Nebraska-Lincoln, Lincoln, Nebraska 68588

Chromatographic immunoassays are gaining popularity in clinical laboratories due to a variety of reasons, including speed and reproducibility. However, many immunoassay techniques involve the use of radioisotopes for the benefit of low limits of detection, but the use of these compounds has several disadvantages, including the training of personnel and waste disposal. This research focused on developing a chemiluminescence detection method for chromatographic immunoassays using acridinium-ester labeled antibodies with hydrogen peroxide and sodium hydroxide as the initiation reagents. The optimization of the reagent concentrations and the use of surfactants were studied in order to achieve maximum light production of the chemiluminescence reaction. In addition, the advantages of chromatographic immunoassays as compared to traditional immunoassays will be discussed, as well the benefits of using chemiluminescence as a detection method.

## **CHEMISTRY: ORGANIC AND BIOLOGICAL SECTION**

### **POSTERS**

#### **30. METABOLIC RESPONSES OF CONJUGATED TRIENE AND DIENE FATTY ACIDS IN GOLDEN SYRIAN HAMSTERS**

M.M. Bohan, S. Zhang, A.L. McCleary, E. Hammond and D.C. Beitz

Iowa State University, 313 Kildee Hall, Ames, IA 50011

Conjugated linoleic acid (CLA) has been shown to have antiatherosclerotic, anticarcinogenic, and antiobesity effects. However, the effects of triene conjugated linoleic acid (CLN) have been studied less. The objective of this study was to compare the effects of CLA and CLN on blood and body composition. Forty golden Syrian hamsters were fed standard rodent chow with 3% lipid for 7 weeks. The 3% lipid treatments were control (2.75% soybean oil and 0.25% beef tallow), tung oil (0.9% tung oil and 2.1% soybean oil), or CLA (0.8% CLA and 2.2% soybean oil). Plasma was analyzed for triacylglycerols (TAG) and cholesterol. Liver, muscle and adipose tissue fatty acid composition was determined. Femurs were extracted and density, ash, calcium concentrations measured. There was no significant difference in total cholesterol concentration, bone calcium, bone ash, or bone density among the three treatments. Hamster fed tung oil and CLA treatments had significantly higher TAG concentration than the control group ( $P < 0.05$ ). Liver lipid concentration was elevated in the tung oil and CLA groups. Tung oil significantly increased the c9, t11 CLA isomer and t9, t11 CLA isomer concentration in adipose, liver, and muscle lipids compared with both control and CLA groups. No accumulation of CLN was detected. Overall, CLA and CLN treatments resulted in similar effects on blood and body composition.



### 31. ANALYSIS OF THE MOLECULAR COMPONENTS OF THE CEMENT-LIKE SECRETION OF THE MARINE WORMS, *PECTINARIA GOULDII* AND *PHRAGMATOPOMA LAPIDOSA*

D. Briggs, H. Edwards, A. Watson, T. Tauer<sup>1</sup>, and M. Dean<sup>2</sup>  
<sup>1</sup>Department of Biology, <sup>2</sup>Department of Chemistry, Coe College, 1220 1<sup>st</sup> Ave., Cedar Rapids, IA 52402

Two annelids belonging to the polychaete family, *Pectinaria gouldii* and *Phragmatopoma Lapidosa*, were studied because of their unique method of building protection for themselves. *Pectinaria gouldii* makes a conical shaped tube out of sand grains or coral that is held together by cement. *Phragmatopoma lapidosa* is a gregarious, reef building worm and makes the reef out of sand grains and similarly sized particles in the tide. We have investigated the cement that the worms secrete that holds the particles of their enclosure together. A set of analytical tests was used to indicate the presence of protein and inorganic components within the cement structure. Electron dispersive spectroscopy was used to identify inorganic components. The molecular weights of protein components were determined through denaturing polyacrylamide gel electrophoresis and silver staining. Coomassie stained bands for both for both species were obtained and analyzed with mass spectroscopy following a trypsin digest. Partial sequence data obtained from mass spectroscopy showed an overlap occurred between a *Pectinaria* fragment (mass 1092.4) and *P. lapidosa* fragment (1092.6). we will use this sequence to generate the probes that can be used to isolate the gene(s) within the cDNA library of each species.

### COLLEGE SCIENCE TEACHING SECTION ORAL PRESENTATIONS

#### 32. CLASSROOM TESTING OF THE ATEEC CLIMATE CHANGE MODULE

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Physical Science students at Clinton Community College study a variety of topics in the physical and earth sciences. The issue of climate change and global warming provides an opportunity to integrate science from several disciplines such as physics, chemistry, meteorology, geology, and astronomy in the understanding of a controversial issue. Teachers from the Advanced Technology Environmental Education Center (ATEEC) have met during the summer at the University of Northern Iowa for the past ten years to develop curricula related to environmental technology education. This past summer they collaborated with Jeffrey Steinfeld and his Colleagues at the Massachusetts Institute of Technology to develop the Climate Change learning module. The module includes an overview of the science of climate change and global warming, especially the anthropogenic impacts on global warming.

Students in the Physical Science class use the module to learn about global change and use the module itself to

investigate various aspects of climate change. Many Internet links are included in the module to allow the student to investigate certain topics in depth. Each week students are asked to report on their findings to the rest of the class. The students' findings are discussed and refined. Prior to starting the module students take a pretest. Upon completion of the module a post-test is given to measure learning gains.

### 33. UNI PHYSICS INSTITUTE- A PROFESSIONAL DEVELOPMENT PROGRAM FOR OUT OF AREA HIGH SCHOOL PHYSICS TEACHERS

L.T. Escalada, J. Moeller, and A. Conley  
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The UNI Physics Department in collaboration with the UNI Science Education faculty and with funding from the U.S. Department of Education offered a two-year professional development program for a cohort of under-prepared and unendorsed Iowa high school physics teachers. The 2002-03 UNI Physics Institute provided the opportunity for the participating teachers to complete the requirements of the Iowa 7-12<sup>th</sup> physics teaching endorsement from one institution under one program. This program provided professional development that integrated physics content with pedagogy consistent with the National Science Education Standards and current physics and science education research. Participants were introduced to the latest and innovative instructional resources and strategies available to teach the high school physics including PRISMS and Modeling. Participating teachers were provided free tuition, stipends, and funds to obtain instructional resources and materials to be used in their physics classrooms. Teacher and student data were collected to determine the effectiveness of the program. A brief description of the program and the results will be discussed.

### COMMUNITY COLLEGE BIOLOGISTS SECTION

No Posters or Papers

### CONSERVATION SECTION POSTERS

#### 34. RESPONSE OF BAILEY'S EASTERN WOODRAT (*NEOTOMA FLORIDANA BAILEYI*) TO A CONTROLLED FIRE MANAGEMENT REGIME

Ryan Brumm and Craig Hemsath  
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The prairie ecosystem has evolved with fire as being an important factor in determining the structure of the prairie. Today, fire is utilized as a prairie management tool to control spread of invasive species. Bailey's Eastern Woodrat (*Neotoma floridana baileyi*) is an isolated and threatened species of woodrat found only along the middle portion of the Niobrara River in northcentral Nebraska. Controlled burns are used in the woodrat's habitat to control

the spread of Red Cedar. This study attempted to determine whether controlled burns have a beneficial or detrimental effect on woodrat populations. Walking surveys were conducted in various areas of differing fire histories to determine if any significant differences are present in burned areas to unburned areas with respect to woodrat presence and density. Slight differences were observed indicating burned areas being of possible benefit to woodrat populations, but the differences were not statistically significant. Results do not show any dramatic detrimental effects to woodrats from prescribed burning.

### **35. DOES MOWING REDUCE SOD DENSITY AND PROMOTE FORB RECRUITMENT IN A MATURE PRAIRIE RECONSTRUCTION**

Amy L. Carolan, and Laura L. Jackson  
University of Northern Iowa, Cedar Falls, IA 50614

Many mature prairie reconstructions lack diversity but are too competitive for new seedlings to establish themselves. It is possible to reduce competition and sod density for recruitment by defoliating (mowing) adult plants. Our objective in this experiment was to promote forb recruitment through the use of different mowing regimes. To test the effects of mowing frequency, 18, 15m x 20m plots were assigned to one of three mowing regimes, and were broadcast seeded with 10 species of native forbs. To measure above and below ground effects, crowns of mixed warm season grasses and two native forb species were extracted, dried and weighed. Seedlings were counted by species using 12, 0.25m<sup>2</sup> quadrats in each plot. The results showed that typically mowing did reduce crown size, however it did not have a positive or negative affect on initial seedling establishment. While mowing does appear to reduce sod density it does not affect seedling germination, however it is too soon to tell if mowing affects seedling survival.

### **36. CLASSIFICATION OF IOWA WETLANDS USING AN AIRBORNE HYPERSPECTRAL IMAGE: A COMPARISON OF SPECTRAL ANGLE MAPPER (SAM) CLASSIFIER AND AN OBJECT-ORIENTED (OO) APPROACH**

James Harken and Ramanathan Sugumaran  
Department of Geography, University of Northern Iowa,  
Cedar Falls, IA 50614

Wetlands mapping using multi-spectral imagery from Landsat MSS and TM, and SPOT do not in general provide high classification accuracies because of poor spectral and spatial resolutions. This study tests the feasibility of using high resolution hyperspectral imagery to map wetlands in Iowa with two non-traditional classification techniques: the Spectral Angle Mapper (SAM) and a new non-parametric object-oriented (OO) classification. The software used was ENVI and eCognition. Accuracies of these classified images were assessed using the information collected through a field survey with a Global Positioning System (GPS) and high resolution Color Infrared (CIR) images.

Validation with field sampling data showed wetlands were identified more accurately using the object-oriented method (overall accuracy 91.7%) as compared to the SAM (68.2%).

### **37. CONTRASTING EFFECTS OF HABITAT QUANTITY AND QUALITY ON SPECIES DIVERSITY OF LEPIDOPTERA IN RESOTRED SAVANNAS**

M. N. Lewis, R. M. Steichen, and K. S. Summerville  
Drake University, Des Moines, IA 50311

Tallgrass prairie and oak savannas now comprise less than 1% of the vegetation in Iowa. Thus, the conservation of native plant and animal diversity will require a commitment to habitat restoration. Animals, however, are often too costly to re-introduce over broad areas, so many land managers have opted for a more passive approach to faunal restoration. The success of this technique, however, is predicated on the assumption that colonization of a site from the regional species pool is favorably influenced by changes in environmental variables following restoration. The goal of this study was to test whether estimates of habitat quantity or quality, measured at different spatial scales, were significant predictors of lepidopteran diversity in mixed woodlands being restored to oak savanna. In 2003, we sampled Lepidoptera and 11 environmental variables from 13 woodland remnants at Neal Smith National Wildlife Refuge in central Iowa. Principle components analysis partitioned the environmental variation along three gradients defined by: stand size and topography, management history, and connectivity. Multiple regression detected that total moth richness was a function the first principle component. In contrast, richness of moth species known only to feed on oaks was significantly affected by all principle components. Increased connectivity was negatively correlated with the species richness of oak feeders. Our results suggest that the success of restoring native lepidopteran communities will be significantly influenced by the size of the remnant being managed. More importantly, however, our data indicate that historic land use and regional patterns in habitat availability are critical factors in determining the re-assembly of lepidopteran communities in restored savannas.

### **ORAL PRESENTATIONS**

### **38. BUILDING COMPREHENSIVE GEOSPATIAL MODELS OF AMPHIBIAN HABITATS IN YELLOWSTONE NATIONAL PARK**

P.E. Bartelt<sup>1,2</sup>, A.L. Gallant<sup>2</sup>, and R.W. Klaver<sup>2</sup>  
<sup>1</sup>Waldorf College, Forest City, IA 50436, <sup>2</sup>USGS/EROS Data Center, Sioux Falls, SD 57198-0001

The USGS Amphibian Research and Monitoring Initiative (ARMI) is charged with providing essential scientific information to support effective management actions to arrest or reverse amphibian population declines. Predictive models that illustrate how amphibians use the landscape would be valuable for designing surveys, studying habitat relationships, and developing land management plans to

conserve amphibian populations. We are building geospatial models of landscape suitability for amphibians that integrate the elements of both breeding (wetland) and terrestrial habitat requirements. We modeled breeding habitats using a statistical probability approach that incorporated an ancillary model of potential available wetlands, additional predictor variables, and ARMI survey data on actual amphibian wetland use. Terrestrial habitats were modeled based on first principles of environmental biophysics by using mechanistic models of amphibian physiology (developed by Warren Porter, University of Wisconsin-Madison) in conjunction with surface models of weather and vegetation cover density. By combining the breeding and terrestrial habitat models, we are building comprehensive models of landscape suitability maps for amphibians. Model refinement is underway to improve the comprehensive models. Future research will include development of cost-surface models and application of similar models to other regions.

### 39. RESPONSE OF BAILEY'S WOODRAT TO A FIRE MANAGEMENT REGIME

David A. McCullough

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The purpose of this study is to examine the response and adaptation of Bailey's woodrat to a renewed fire regime and assess any impact fire has on population morbidity and stability. Bailey's woodrat is federally listed as a threatened subspecies of the Eastern woodrat (*Neotoma floridana baileyi*). This listing is based primarily on population disjunction and presence of available habitat. Although moderately common, these populations of woodrats have been deemed sensitive because of the fragile, limited ecosystem they inhabit.

Initial analysis of nest locations indicate that Bailey's woodrat avoids dense stands of woody vegetation. In contrast they seem to prefer moderately spaced larger base diameter trees. This seems most obvious and relevant with respect to Red Cedar. Very few if any nests are found in dense thickets of younger Cedar. In contrast, where larger Cedars are found in a mixed deciduous (often in conjunction with Bur Oak) setting or Cedar Savannah-like (Cedars on draw or valley/prairie ecotone) setting, nests are common. The intuitive interpretation of these observations is that woodrats should respond positively to an active fire management regime to control excess woody vegetation.

### 40. TOWARDS AN INVENTORY OF THE FUNGI OF IOWA PARKS AND PRESERVERS: A DATABASE OF RECORDS FROM MYCOLOGISTS PAST AND PRESENT

R. Healy, L. H. Tiffany, and L. McCormick  
Iowa State University, Ames, IA 50011

A project is under way to put together an inventory of Iowa woodland and prairie fungi, including slime molds and

lichens. Work has proceeded from two directions. Information from the field notebooks of Dr. George W. Martin (1920's to 1950's) and Dr. Lois H. Tiffany (1950's to present) and from herbarium specimens housed at Iowa State University have been recorded, while forays into selected state parks and preserves during the past three years have expanded the information base. Martin's notebooks, and the herbarium specimens provide data from some early Iowa mycologists and botanists such as T.H. Macbride, B. Shimek, G.W. Carver and L. Pammel. Efforts have focused on recording information from public lands in Iowa so that a baseline of species can be constructed and used for future inventory work. Information includes identification, substrate or host, collector, location, date of collection and whether there is a voucher specimen in the herbarium. The most extensive species lists are from Fort Defiance State Park, Ledges State Park, Pilot Knob State Preserve and White Pine Hollow State Preserve. Currently the database has 16,000 records. The oldest records are from the late 1800s.

### 41. GENETIC VARIATION OF *SCHIZACHYRIUM SCOPARIUM* (LITTLE BLUESTEM) USING AFLP

Renae DeVries and James Jurgenson

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

Only about 0.1% of Iowa's original prairies remains and preservation solutions are being explored to conserve these dwindling plant populations that grow on unfavorable land conditions. One solution being explored is cultivating native seed in common plots. In order to be successful, the genetic similarities between the northern, central, and southern varieties of Little Bluestem must be studied to ensure the most suitable plants are being used. The CEQ 8000 Genetic Analysis System has been used to detect fluorescently labeled DNA fragments produced by AFLP analysis of genetic diversity in native plant species collected from natural populations. Little Bluestem (*Scizachyrium scoparium*) has been collected from prairie remnants in all latitudes of the state. Analysis of these populations reveals the genetic relatedness of plants found in each of these populations within and between populations.

### 42. GENETIC VARIATION OVER TWO GENERATIONS OF THE NATIVE PRAIRIE PLANTS: *PANCIUM VIRGATUM* AND *COREOPSIS PALMATE*

Faith Kruse and James Jurgenson

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

Collection of native seed from prairie remnants and propagated in field plots for the purpose of seed increase is presently the common practice used to obtain sufficient seed stock for restoration of native prairies. Of primary concern to most conservationists is that the genetic diversity of the seed thus produced be diverse and contain genetic strains that will thrive in the location it is planted.

This project involves using amplified fragment-length polymorphisms (AFLP) to study the genetic variation over three generations of seed increase of the native prairie plants: *Panicum virgatum* and *Coreopsis plamate*. DNA is extracted from frozen plant tissue by a diatomaceous earth extraction protocol and the DNA profiles generated by the DNA fingerprinting technique AFLP are determined. The Beckman CEQ 8000 Genetic Analysis System is then used to detect fluorescently labeled DNA fragments produced by AFLP. Genetic profiles of individual plants can be compared within and between populations of native growing plants in different prairie remnants as well as to that of commercial cultivars and offspring of the native plant collections. Previous results have indicated that native seed diversity may increase when propagated in plots.

## ENGINEERING SECTION

### ORAL PRESENTATIONS

#### 43. VIRTUAL SOLDIER RESEARCH AT THE UNIVERSITY OF IOWA

Karim A. Abdel-Malek

University of Iowa, Iowa City, IA 52242

Human modeling and simulation technologies are being developed by members of the Virtual Soldier Research (VSR) program at the Center for Computer Aided Design of the University of Iowa. This team of 84 members is developing state-of-the-art technologies for creating human-like avatars that live in the digital world and that are able to evaluate and test products before they are built, in the virtual world. The aim is to make a significant impact on the way military products are designed, thus reducing the costs and enabling new technologies. These intelligent characters can be designed to be male or female, with known dimensions (anthropometry), and can be asked to perform various tasks on systems and vehicles that are yet to be built. Using intelligent modules for posture and motion prediction, these human-like figures are able to respond in real-time, while human mathematically-based human performance measures are being monitored to identify potential injury and pain and simultaneously testing the equipment's functionality. Dr. Abdel-Malek, Director of VSR, will briefly describe the effort.

#### 44. PERFORMANCE ANALYSIS OF A SCENE GRAPH IN COMPUTER GRAPHICS

Shailesh Kumar

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The idea of a scene graph is to store the whole scene in the form of a heterogeneous graph of connected objects. While rendering the scene, the graphics engine traverses the scene graph and renders it as an image after performing all the optimizations that a scene graph does on the scene. Performance plays a big role in the success of a graphics application built using scene graphs.

This work presents the design and implementation of an extensible performance monitoring system for a scene graph. We investigate the various factors which can affect the performance of a scene graph. The effects of these factors on performance can be demonstrated by selecting different parts of a scene graph separately and calculating the frame rate or by investigating if there are some unnecessary state switches. There may be a few parts of the scene graph which are not very important but which may have a very high number of polygons hence causing the performance to decrease. We discuss the ways in which we can diagnose the scene graph and find out which of the various factors are actually hampering the performance of a scene graph. The described concepts have been implemented in the OpenSG scene graph and can be extended to various other scene graphs.

#### 45. DEFORMABLE SOLID MODELING USING NURBS-BASED FINITE ELEMENT METHOD

Xianlian Zhou and Jia Lu

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Deformable modeling techniques have been used in computer graphics for decades. However, most of the existing methods either use overly simplified physical models or don't consider the underlying mechanics at all. In this contribution, we propose a novel physically based deformable modeling technique which is efficient and yet retains the mathematical rigor of the finite element method. The finite element discretization is built directly using the NURBS shape functions that are used in geometric representation. Thus, it permits us to describe the shape of the body rather accurately without introducing excessive number of degree of freedoms. We will present the method with B-spline closed surface/curve models. A crucial step is to extend the surface/curve models into body/surface discretization, which we will discuss in detail.

The Method is essentially a hybrid meshless/mesh finite element formulation. However, two important properties of B-spline functions, namely, partition of unity and affine invariance, are crucially exploited. These properties ensure that the rigid body motion as well as the linear displacement field can be exactly recovered. As a result, the classic patch test in FEM will be satisfied. The method can be readily extended to large deformation and inelastic behaviors of solid models. In application, the formulation will be used for real-time simulation of the motion of major muscle in human limbs.

#### **46. SEPARATION AND RECOVERY OF UNBURNED CARBON FROM FLY ASH**

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The presence of unburned carbon in fly ash produced by coal combustion limits the use of fly ash in air entrained concrete which is the principal outlet for large quantities of fly ash. Consequently there is need for an efficient method of removing the unburned carbon. This research has shown that a froth flotation process, which is widely used for separating mineral particles with different wetting characteristics, can be adapted to the separation of carbon particles and ash particles which also have different wetting properties. The key to success was finding a combination of chemical reagents which selectively increased the hydrophobicity of the carbon particles while not affecting the surface of the ash particles. It then became possible to separate the particles in an aerated, aqueous suspension which enabled the selective attachment of carbon particles to gas bubbles and their removal in a froth layer.

The method was applied to the separation of carbon from Type F fly ash obtained from several different sources which varied in carbon content. In one case the carbon content was reduced from an initial level of 16.5% to a final level of 1.5% with an ash recovery of 74%. In another case the carbon content was reduced from 11% to 1.0% with an ash recovery of 77%. These results are highly encouraging, since a final carbon content of 2-3% is believed acceptable.

#### **47. ENHANCING PRODUCER GAS HEATING VALUE USING A BALLASTED GASIFIER**

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Our goal is to enhance the heating value of gas produced during gasification of biomass fuels using an indirectly heated gasifier equipped with a latent heat ballast. At Iowa State University, we have developed a thermally ballasted, fluidized bed gasifier that uses a single reactor for both combustion and pyrolysis. Instead of spatially separating these processes, they are temporally isolated. The latent heat ballast consists of lithium fluoride salt encased in tubes suspended in the reactor. The lithium fluoride has a melting point that is near the desired gasification temperature. With the ballast, a single cyclically operating reactor stores energy during a combustion phase and releases it during the pyrolysis phase to support its endothermic reactions.

Because air is not used during the gas-producing phase of the cycle, nitrogen does not dilute the product gas, resulting in relatively high concentrations of hydrogen and carbon monoxide in the producer gas compared to conventional gasifiers. We have measured hydrogen content between 20 and 30 vol-%, which is a factor of 3 to 4 times higher than found in gas from air-blown gasifiers. The thermal

ballasting system also more than doubles the carbon monoxide concentration. Additionally, the total fuel fraction converted to fuel gas increased from 74% to 80%. Higher heating values of 14.2 to 16.6 MJ Nm<sup>-3</sup> (382 to 445 Btu scf<sup>-1</sup>) on a dry basis were obtained from the ballasted gasifier.

#### **48. A COMBINED CATALYST/SORBENT FOR PRODUCING HYDROGEN FROM HYDROCARBONS**

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The development of a combined catalyst and sorbent for improving the production of hydrogen from methane and other hydrocarbons will be discussed. The material is designed to promote both the steam reforming and water gas shift reactions by utilizing core-in-shell pellets which consist of CaO cores incased in shells made largely of alumina that serves as a nickel catalyst support. When the material is employed for methane reforming, the hydrocarbon reacts with steam in the presence of the nickel catalyst to produce hydrogen and carbon dioxide. Since the carbon dioxide is absorbed immediately by the CaO in the core, the reaction is driven toward completion.

The preparation and characterization of the catalyst/sorbent will be discussed together with the results of performance testing by means of thermogravimetric analysis and by use of a fixed bed reactor. This testing has shown that the material is capable of catalyzing both the steam reforming reaction and water gas shift reaction with simultaneous absorption of carbon dioxide produced by the reactions. Consequently, a product gas has been produced at reaction temperatures lower than 600°C and atmospheric pressure which contains up to 95% hydrogen and less than 2% carbon oxides.

#### **49. WIND ENGINEERING AND EXPERIMENTAL AERODYNAMICS PROGRAM OF STUDY AT IOWA STATE UNIVERSITY**

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An overview of wind engineering and experimental aerodynamics program of study and description of the associated facilities in the Department of Aerospace Engineering at Iowa State University are presented. This research program focuses on the study of fluid-structure interaction problems, mainly the detrimental effects of wind on civil and mechanical engineering structures, the environment and the people. This multi-disciplinary field of study requires involvement of researchers from various departments of engineering, environmental and atmospheric sciences, statistics and architecture. Tools such as wind tunnels and computational fluid mechanics combined with analytical and statistical methods are used to solve the relevant problems. A world-class Wind Simulation and

Testing (WiST) Laboratory is being setup at ISU. The WiST Lab will house facilities that simulate straight-line gusts, thunderstorm-winds and tornado-like vortices. These facilities are appropriately called the “advanced or next generation” wind tunnels because of their unique capabilities. It will be a state-of-the-art experimental facility for conducting research, education, consulting and outreach for applications in wind engineering, aeronautics and industrial aerodynamics. The WiST Lab will help ISU provide high-quality educational and research opportunities to young engineers to prepare them for the challenges of the 21<sup>st</sup> century.

#### **50. DETERMINATION OF AERODYNAMIC COEFFICIENTS OF A PARAFOLIO USING THREE DIMENSIONAL MODELING AND EXPERIMENTAL VERIFICATION**

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At Iowa State University there is a project called High Altitude Ballooning Experiments in Technology (HABET) which launches various payloads into high earth atmosphere. As the sophistication of the electronic package and the value of the payloads increased, a desire to insure the safety of the payload developed. Currently the recovery system is a circular parachute that is uncontrollable. This has led to the payload landing in places that are inconvenient to the recovery team, such as railroad tracks, highways, or private property. There is also a danger that the payload could harm people, damages personal property in landing or land in a place that is unrecoverable like a lake or a stream.

This inability to control the landing has led to the development of the Recovery Guidance System (RGS) project. The goal of the RGS project is to have the payload use on onboard Global Positioning System (GPS) receiver to determine its location. Then it will use existing weather conditions to determine how far it can go and select a preprogrammed landing site within its range. In designing a control law for the parafoil and payload there was an essential need to gain a better understanding of the aerodynamic coefficients of the parafoil selected for the project. The first step was to use a two dimensional lifting line to get the aerodynamic coefficients for lift.

#### **51. BYPASS THROTTLING ON A SMALL WIND TUNNEL**

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Wartburg College has a small, student-built wind tunnel driven by a constant speed fan. The current project was to make modifications to the wind tunnel that would allow the experimenter to control the air speed in the test section of the tunnel.

The wind tunnel is of the open-circuit type with a fan on one end that draws air through, creating negative gauge pressure throughout the tunnel. One way to control the flow speed is to lower the dynamic pressure in the test section by raising the static pressure immediately before the fan section. This was done by building a plenum to act as a bypass throttle. The plenum was placed on the section preceding the fan. When the plenum valves are open, the fan draws air preferentially through the plenum that, in turn, increases the static pressure in the test section causing a decrease in speed. Gradually closing down the valves allows for some measure of speed control. Testing continues on the usable speed range. With the completion of the speed control system, the wind tunnel will be ready for student research.

#### **52. REMOTE FIBER OPTIC HEALTH MONITORING: LOCAL AND GLOBAL EVALUATION OF A HIGH PERFORMANCE STEEL BRIDGE**

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Research sponsored by the Iowa Department of Transportation (Iowa DOT) and the Wisconsin Department of Transportation (WisDOT) is underway at the Iowa State University (ISU) Bridge Engineering Center (BEC) to investigate continuous health-monitoring of bridge and components using smart-sensor technology. Long-term monitoring is beneficial to bridge owners because it provides for a nondestructive evaluation of bridge performance over an extended period of time. One important application of health-monitoring systems is to detect and report bridge damage or failure to the owners. However, long-term monitoring also has other purposes; it can also be used to monitor gradual bridge deterioration, the performance of suspect details or new retrofits, magnitude and frequency of overloaded vehicles, etc.

The health-monitoring system employed in this research will be installed on Iowa's first high-performance steel (HPS) bridge. Through the use of health-monitoring system, fatigue sensitive areas and other critical locations within the bridge will be instrumented with fiber optic sensors. The strain at these locations will be continuously collected and analyzed to determine the local (fatigue behavior) and global performance of the HPS bridge. A website will be used to demonstrate the two features of the system: (1) real-time video of traffic crossing the bridge, and (2) graphs of the strains measured at the sensor locations, which correspond to the traffic shown in the video. The information collected by this health-monitoring system will be used to verify the fatigue behavior of HPS, help promote the use of HPS bridges, and demonstrate the usefulness of health-monitoring systems to bridge owners.

### **53. ROBUST CONTROL OF PNEUMATIC ACTIVE AUTOMOBILE SUSPENSION**

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The main objective of the paper is to design a robust active control system for vehicle suspension to improve ride comfort for passengers. For the purpose of simplicity, the dynamics of the pneumatic suspension system is modeled using a simple 2-DOF quarter car model. An  $H_\infty$  robust control technique is used for the design of the controller and its performance is compared with a previously designed iterative robust LQG controller. The objective of the robust control design methodology is to find a stabilizing controller  $K$ , which based on the information obtained from the measured outputs, generates appropriate control inputs so as to minimize the  $H_\infty$  norm of the transfer matrix from the exogenous inputs on the performance outputs. In other words, the controller is designed to attenuate the harmful effects of the exogenous inputs on the performance outputs by providing the plant with suitable actuation. The problem is formulated as a stacked S/T/KS nominal performance problem where the weighting functions chosen not only reflect performance measures but also act as upper bounds on the magnitude of the uncertainties present in the system. Finally, singular value and  $\mu$  analysis are performed to ascertain the robustness of the closed loop system for each of the controllers designed. The  $H_\infty$  controller so designed is not only shown to be robustly stable to plant uncertainties but also delivers robust performance which is an improvement over the previously designed robust LQG controller.

### **54. ULTRASONIC MODELING AND SOME OF ITS APPLICATIONS AT THE CENTER FOR NDE, IOWA STATE UNIVERSITY**

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Since its founding in 1984, the Center for Nondestructive Evaluation (NDE) at Iowa State University has been a world leader in developing computer simulation models of ultrasonic NDE inspections and applying those models to significant industrial problems. Here, we will describe how models have been used to describe all the elements of an ultrasonic NDE inspection system, including the conversion of a voltage pulse into acoustical energy at the face of a transducer; the propagation of that acoustical energy in the form of a sound beam traveling through a structural component; the interaction of the sound beam with a flaw, such as a crack, in the component; and the conversion of the received acoustical energy back into electrical signals that can be displayed.

Having the ability to simulate all the physics involved in an ultrasonic inspection process has made it possible to analyze and optimize NDE inspections in some important applications. We will describe how our ultrasonic NDE models have been used to develop inspection protocols for

inspecting through curved surfaces – a capability that has led to major cost savings in the inspections of large power generation turbine rotors. We also will describe the use of modeling to improve the inspection of titanium for the type of flaw that caused the engine explosion and subsequent crash of a DC-10 at the Sioux City airport in 1989.

### **55. A FINITE ELEMENT METHOD TO PREDICT THE ENERGY ABSORPTION IN A LONG FIBER COMPOSITE CRUSH TUBE**

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Past research has conclusively shown that long fiber structural composites possess superior specific energy absorption characteristics as compared to steel and aluminum structures. Up to this point there has been very little work to attempt to predict the energy absorption of composite crush structures. This paper chronicles some preliminary efforts to predict energy absorption in a thin walled composite structure during a dynamic crush event. This paper employs the popular FEA software package, LS-DYNA, to simulate the dynamic crush event of a S2 glass/epoxy cylindrical tube. The model employed is “progressive failure model”, which employs (1) matrix cracking, (2) compression, and (3) fiber breakage failure modes. All tubes were nominally 5 inches in length by 1-inch diameter with a 6-ply thickness of 0.075 inches. The sample set is comprised of 7 simulations of  $\pm\theta$  and 7 simulations of  $0^\circ\pm\theta$ , where theta varied from approximately  $0^\circ$  to  $90^\circ$ . The predicted values were found to compare reasonably well with both static and dynamic experimental results.

### **56. MECHANISMS INFLUENCING NET SECTION STRENGTH IN ALUMINUM FOAM**

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Aluminum foam with its superb weight normalized properties becomes an ideal component in sandwich panels. In addition, its ability to absorb high energies makes it ideal for impact absorption systems. Its behavior in the presence of notches is not well understood and is important whenever aluminum foam is to be secured to other structures through the use of bolts, rivets or other fasteners.

An experimental investigation finding the limit load, net section strength for Double Edge Notched (DEN) and Single Edge Notched (SEN) specimens tested in compression, makes it possible to look at the macroscopic behavior of this foam. Through a series of images taken during the deformation it is also possible to look at deformation at the cell level. The correlation between macroscopic and microscopic behavior reveals the causes behind an increase in net section strength for the DEN specimens and no increase seen in the SEN specimens.

## 57. ABRASION STUDY OF NEW ULTRA-HARD AIMgB<sub>14</sub> MATERIALS MODIFIED BY TiB<sub>2</sub>

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Noncrystalline AIMgB<sub>14</sub> containing 0-50 mol% TiB<sub>2</sub> are a family of new super hard materials with hardness comparable to that of TiB<sub>2</sub> at the lower end and of cubic boron nitride (CBN) at the higher end. AIMgB<sub>14</sub> is an equilibrium material with excellent electrical conductivity, high chemical stability, and low density. These attributes make these materials promising for varied applications. The projected cost of manufacture of these boride materials is about 10% of the cost of diamond and CBN, which are the competing materials.

The machining of the boride materials is difficult because of high hardness which contributes to high abrasion resistance. In order to study the abrasion resistance, single point scratch tests were run on ultra-hard AIMgB<sub>14</sub> modified by TiB<sub>2</sub>. A Rockwell diamond indenter with a linear traverse motion was used for scratch tests. The material removal rate was determined in terms of the width of wear scar by optical microscopy and laser profilometry. Scanning electron microscopy (SEM) and energy dispersive X-ray analysis (EDXA) were employed to observe the morphological and chemical features of subsurface damage. It was found that the subsurface damage was greater in the materials with higher hardness values.

## 58. STRUCTURAL ANALYSIS AND OPTIMIZATION OF FLUID LOADED LAMINATED COMPOSITE CANARD

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Structural optimization on a laminated composite canard subjected to static aerodynamic loads was carried out numerically. An integrated design approach, a FEA program coupled with aerodynamics subroutines based on shear deformation theories, was developed to calculate the deflection and transverse stresses. Coupling exists between the aerodynamic pressure and deflection of the flexible canard when calculating the loads on the plate. The pressure results in deformations of the canard. The deformations in turn modify the pressure field and the resulting loads. A feedback loop of canard behavior and overall pressure distribution in a fluid field was implemented to achieve the final equilibrium results.

This study also presents a gradient-based numerical approach for the unconstrained and constrained design optimization. It was observed that proper stacking sequence of the laminated composite canard improves its mechanical performance. In constrained optimization work, minimum weight with adequate strength and stiffness was obtained by optimizing plate thickness. A Fortran program including FEA, aerodynamics subroutines, and CONMIN an

optimization subroutines, was employed to carry out the investigations. It was demonstrated that the application of composite materials is really helpful in developing a new canard or improving the existing design because composite materials are much stronger in the fiber direction as compared to the transverse direction.

## 59. COMPUTATIONAL NANO-MECHANICS: FROM MOLECULAR DYNAMICS TO MULTISCALE METHODS

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Advances in the synthesis and applications of nanoscale materials and devices have stimulated intensive research activities in nanotechnology. As one of powerful tools, molecular dynamics simulations can be used to elucidate complex chemical and physical phenomena. However, it has been shown that molecular dynamics simulations have limitations on both length and time scales. Therefore, multiscale methods are needed. Multiscale methods can be divided into two classes: hierarchical multiscale methods and concurrent multiscale methods. In hierarchical modeling, the continuum approximation is used to model a large group of atoms. The intrinsic properties of material are sought at the atomic level and embedded in the continuum model according to so-called Cauchy-Born rule. Concurrent multiscale methods use an appropriate model to solve each length scale simultaneously. Here, a new concurrent multiscale method, named bridging domain coupling method, is introduced. This method couples molecular dynamics with continua via an overlapping domain (or a bridging domain). The Lagrange multiplier method is used in bridging domain to conjunct the molecular domain and continuum domain. A scaling of the molecular and continuum Hamiltonians is also applied in the bridging domain so that the total Hamiltonian is a linear combination of the molecular and the continuum Hamiltonians. An explicit time integration algorithm is developed so that this multiscale method can eliminate the spurious wave reflection occurring around the interface between continuum domain and molecular domain without any additional filtering processing.

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## ENVIRONMENTAL SCIENCE AND HEALTH SECTION

### POSTERS

#### 60. PLACE BASED MONITORING IN ENVIRONMENTAL PROTECTION: A SAFE DRINKING WATER ACT CASE STUDY

Edwin Brands

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With the intent of protecting human health and/or ecosystems, federal environmental statutes and regulations are often implemented uniformly across the country with only small allowances for flexibility. Such an approach often fails to address spatial and temporal variability. In this research, a place-based approach is applied in the context of water quality monitoring under the Safe Drinking Water Act (SDWA) of 1974. SDWA monitoring informs consumers about water quality as well as billion dollar decisions regarding water treatment, and infrastructure improvement and replacement.

To test the merits of place-based monitoring, historical water quality data were reviewed from a group of nineteen Iowa surface water-influenced supplies. Several alternative sampling strategies were defined (along with the current SDWA strategy) and implemented on a worst-case scenario test dataset. Strategies were evaluated on several measures, including percentile estimation (e.g. 90, 95, 99), and estimation of "true" concentration curves. Results indicate only a few contaminants are of concern in any one given water supply, temporally flexible strategies can significantly improve the ability to estimate key distributional parameters, and funds conserved by eliminating testing of non-occurring contaminants could be reallocated to existing or emerging contaminants of concern.

#### 61. DISTRIBUTION OF PESTICIDES IN IOWA RIVERS

Rebecca Hulse

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Nonpoint source pollution is the leading threat to surface water quality in Iowa. Runoff from agricultural and urban areas introduces herbicides into Iowa's surface waters, posing potential risks to the environment and human health. Using data collected by the Iowa Department of Natural Resources Ambient Water Monitoring Program, this report offers a spatial and temporal analysis of some of the most prevalent herbicides in Iowa rivers. The herbicides included in this study are atrazine (including its degradates desethyl atrazine and desisopropyl atrazine), acetochlor, dimethenamid and metolachlor, all of which have been consistently monitored since October 2000 at sites across the state. Spatial analyses were performed at the 8-digit watershed level to identify areas of high concentration and/or detection frequency, while temporal analyses illustrate the seasonal fluctuation of herbicide concentrations in Iowa's ambient waters. As herbicide contamination is not uniform across the state, knowledge of

seasonal and geographical variation may assist Iowa's leaders in future resource allocation decisions.

### ORAL PRESENTATIONS

#### 62. DETERMINING THE SOURCES OF FECAL POLLUTION TO SILVER LAKE, IOWA

Jacinta Uzoigwe and Ed Brown

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Methods to identify sources of fecal pollution are important because fecal contamination of water is still a widespread problem in the United States. Bacterial Source Tracking (BST) is being used to determine the sources of fecal bacteria in environmental samples (e.g. from water, human, livestock, or wildlife origin). Methods of BST include profiles of phenotype (characteristic patterns expressed by isolates) and genotype. Phenotypic methods include Nutrient Utilization Profiles and Multiple Antibiotic Resistance Analysis (MAR) while the most popular genotypic method is Ribotyping. In this study, a comparison was made between two phenotypic methods of BST. A nutrient utilization profile was compared to results obtained with MAR profiles of sources of fecal pollution in the Silver Lake watershed, Delaware County, Iowa. A total of three hundred *Escherichia coli* isolates collected from different sources (water, birds, geese, soil, cattle and hog) were analyzed. The *E. coli* isolates from geese, bird, cattle, and hog were observed to have different characteristic patterns of nutrient utilization which were compared to isolates from water. The results indicate that the primary sources which contribute to the fecal pollution of this hypereutrophic lake are cattle and hogs.

#### 63. FATE AND TRANSPORT OF PHOSPHATE THROUGH THE BEAVER VALLEY WETLANDS OF THE CEDAR RIVER WATERSHED

Renee Pasker, Ann Schwemm, Maureen Clayton and Ed Brown

Environmental Programs University of Northern Iowa Cedar Falls, IA 50614-0506

Excess phosphorus can lead to eutrophication of aquatic ecosystems, which can indirectly cause many species to suffer due to lower oxygen levels. The intent of this project was to determine if wetlands draining agricultural soil in the Cedar River Watershed are removing phosphorus prior to emptying into a tributary of the Cedar River. To determine the fate and transport of phosphorus in the wetlands, the total phosphorus (TP) of both the water and sediments was measured, and the ability for sediments to remove phosphate was also determined. The TP in the water column in the wetlands varied temporally from 700 to 1700 ug P/L. Dissolved inorganic phosphate (SRP) totals were usually low, with a modest spike observed after a rainfall event. The low levels of SRP in the water led to testing TP levels in sediments and SRP sorption capacity of sediments. The TP of the sediment varied spatially from 500-700 ug P/gdw sediment. Sediments from the tributary (Beaver Creek) had

total phosphorus levels of about 500 ug P/gdw and the inlet to the wetlands varied from 300-400 ug P/gdw. Depending on sampling locations, maximum sorption for sediments from the main body of the wetland ranged from 2-9 mg P/gdw sediment. Sediments from both the tributary (Beaver Creek) and the inlet to the wetlands had maximum SRP sorption capacity of approximately 7 mg P/gdw. The results suggest that sediments in the wetlands are not yet saturated with phosphorus and therefore, when aerobic, can prevent phosphorus transport to rivers and streams.

#### **64. EFFECTS OF INCREASED PHOSPHORUS INPUTS ON IOWA'S SURFACE WATERS**

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Many studies have documented the role of phosphorus (P) in contributing to the eutrophication of water bodies; however questions on the fate and transport of P in the environment remain. Methods used to determine impacts of P on Iowa's water consisted of: 1) Comparison of in-stream and lake [P] to EPA benchmark levels; 2) Comparison of in-stream and lake [P] to biological indicators; 3) Determination of relationships between various land uses and measured [P]; and 4) Comparison of P inputs to stream and lake [P] established from Iowa's nutrient budget.

Results indicate that increased phosphorus in Iowa's water bodies has negative impacts on aquatic communities and may have recreation and human health impacts. Linking sources to P in water bodies is difficult due to complex delivery and transformation mechanisms in the environment. Urban areas appear to increase [P] downstream, although scope is currently unknown. Agricultural fertilizers and manure relate to higher dissolved [P] in streams. As a whole, Iowa water bodies exceed EPA benchmarks in nearly 70% of the samples. Because dry conditions have persisted during the three years of intense monitoring, it is likely this number is low compared to years of normal precipitation.

#### **65. TMDL MONITORING PROTOCOLS AND ASSOCIATED FIELD COLLECTION ISSUES: THE IOWA PROGRAM**

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University of Iowa. Iowa City, IA

The TMDL monitoring strategy in Iowa is two-fold and a cooperative effort between the Iowa Department of Natural Resources and the University of Iowa Hygienic Laboratory. Monitoring consists of the collection of monthly grab samples to measure ambient concentrations of nutrients (nitrogen and phosphorus forms), various solids components, pesticides, bacteria and chlorophyll. Event monitoring, primarily for rainfall runoff is performed at the same locations as the ambient monitoring and completed each time stream discharge levels reach seasonal threshold

values based on historic stream gauging information, where available. Field measurements for temperature, pH, dissolved oxygen and instantaneous flow are also taken at the time of sampling. The purpose of this presentation will be to discuss the comprehensive event monitoring strategies that have been employed to gain information on loading rates of contaminants. Funding for this TMDL program is provided by the Iowa Department of Natural Resources.

#### **66. EFFECTS OF BEST MANAGEMENT PRACTICES ON WATER QUALITY IN SNY MAGILL CREEK**

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From 1991 to 2001 intensive monitoring was conducted in Sny Magill Creek to assess the effectiveness of best management practices (BMPs) placed in the watershed to improve surface water quality. During the 10- year project over 30 different BMPs were implemented in the watershed to reduce nutrient, sediment, and fecal coliform runoff into the stream. Even-interval water quality samples were taken at six locations on Sny Magill Creek, and three locations on its paired control watershed, Bloody Run Creek.

Regression models were used to give quantitative estimates of water quality changes that occurred during the study. These models were used on three paired sets of water quality data. During the study, nitrate-nitrite concentration increased in Sny Magill relative to Bloody Run on all three paired sites despite BMP implementation. However, other important water quality indicators showed improvements. Turbidity, fecal coliform, temperature, and suspended solids decreased, while dissolved oxygen levels increased in some or all of Sny Magills' paired sites. These results will help expand knowledge on effective use of BMPs for improving water quality in agricultural streams.

#### **67. DOES ATRAZINE AFFECT THE CELL GROWTH OF HUMAN WHOLE EMBRYO CELLS?**

Heather M. Krueger, Kavita R. Dhanwada  
University of Northern Iowa, Cedar Falls, IA 50614

Atrazine, a triazine herbicide, is the most widely used pesticide in the United States. Due to its moderate solubility in water, it can contaminate ground and surface water systems after application via runoff, thereby affecting the drinking water supply throughout the agricultural regions of the country. Studies show atrazine has toxic effects on human cells, but the treatment concentrations of the pesticide used in most studies are usually much higher than that found in potable water supplies. In this study, human whole embryo (WE) fibroblasts were exposed to environmentally relevant concentrations of atrazine to determine the effects on cell proliferation. WE cells were exposed to increasing concentrations (0.4 -50 parts per billion, ppb) atrazine and cell growth was measured. Cell proliferation was decreased to statistically significant levels at atrazine concentrations as low as 0.8 ppb, which is

below the MCL (Maximum Contaminant Level) of 3.0 ppb set for atrazine. Western blot analysis to quantitate cell cycle protein p53 showed that levels of this protein were increased in atrazine treated cells suggesting atrazine exposure may lead to growth arrest or apoptosis of cells. We show atrazine affects the growth cycle of immature, embryonic human cells at concentrations that are comparable to those found in the drinking water supply. Further research may also show that atrazine increases the amount of stress within a cell leading to the decreased levels of cell proliferation.

#### **68. THE EFFECTS OF ATRAZINE AND ITS METABOLITES ON HUMAN CELL GROWTH FROM PESTICIDE CONTAMINATED IOWA WATER SOURCES**

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Atrazine is the most heavily used herbicide in the United States and has been widely studied. However, very little is known about the effects of its three primary metabolites, desethyl atrazine (DEA), desisopropyl atrazine (DIA) and desethyldeisopropyl atrazine (DEDIA). To study the effects of these metabolites on normal human cells the MTT cell proliferation assay was used. Three separate analyses were performed. Cells were either exposed to: 1) increasing concentrations of the atrazine metabolites alone, 2) a combination of atrazine (0.46 $\mu$ M) and each metabolite or 3) exposed to Iowa water sources that included atrazine, metabolites and other contaminants. DIA and DEDIA significantly decreased cell proliferation at 1.1 $\mu$ M concentrations compared to untreated cells; however, a concentration of 3.3 $\mu$ M was required to significantly decrease cell proliferation with DEA. Combination studies with atrazine and each metabolite showed significant decreases in cell proliferation compared to untreated cells at each concentration tested. When combinations were compared to cells treated with atrazine alone a statistically significant decrease in cell proliferation was seen at 10 $\mu$ M and higher metabolite concentrations. In contrast, cells grown in pesticide contaminated water samples usually had increased cell proliferation. This study shows that the metabolites of atrazine can affect cell proliferation at relatively low, environmentally relevant levels.

#### **69. MODELING AND MEASURING THE DISPERSION OF ODORS FROM HOG CONFINEMENTS**

F. Bera and A.C. Czarnetzki  
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A comparison was made between predicted and measured odor concentration downwind of two hog finishing confinements. Two Gaussian dispersion models, STINKBAK and AERMOD, were used. The experimental cases examined odor emanating from a mechanically-ventilated facility and a curtain-sided facility during summer 2003. A field olfactometer was used to measure odor

concentration. The odor concentrations served as input to STINKBAK, which then estimated the odor emission rate from the confinement. AERMOD used this emission rate and other meteorological data to predict the peak concentration of odor around the confinement over the sampling hour.

The calculated odor emission rates are slightly higher than those reported in the literature. Odor release from the curtain-sided confinement was found to be higher than the mechanically-ventilated facility. A correlation with ambient temperature was observed.

Measured concentrations were compared to predicted peak concentrations over the sampling hour. The forecast odor plume compared well to the observations. The importance of the meteorological information was shown to be of primary importance in plume forecast accuracy.

### **GEOLOGY SECTION**

#### **POSTERS**

#### **70. BASEMENT LITHOLOGY AND STRUCTURE FROM GRAVITY AND MAGNETIC DATA, NORTHEAST IOWA**

Luke Aaron Johnson  
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A gravity survey was conducted over approximately 5,500 square kilometers of northeast Iowa. The survey was undertaken to provide detailed gravity coverage at approximately one mile intervals and to model the source of several significant gravity and magnetic anomalies. 1,776 gravity stations were occupied in the survey area. A Bouguer anomaly map and several residual maps were constructed. The residual maps were prepared using band-pass filtering and polynomial fitting techniques. Profiles were prepared from the Bouguer Gravity and residual maps, and profile analysis was undertaken to examine the shape, density and magnetic susceptibility of intrusive bodies located within the basement of the study area. Residual maps reveal that the large oval Bouguer gravity anomaly centered beneath Decorah can be traced to the southern border of the survey. Profiles crossing this feature support the interpretation of a mafic (troctolite) intrusive extending over 90 km from the northwest corner of Winneshiek County to near the southern boundary of Fayette County. Shallow clastic basins are interpreted at both the western and eastern portions of the survey area. In the Decorah area, possible Paleozoic faulting suggested by anomalous water well data may be reflecting basement structure.

#### **71. LATE QUATERNARY EOLIAN SAND STRINGERS OF BREMER AND BLACK HAWK COUNTIES, NORTHEAST IOWA**

J. Koch and J. Walters  
Department of Earth Science, University of Northern Iowa, Cedar Falls, IA 50614

The Iowan Surface of Northeast Iowa is a low relief, extensively eroded, Pre-Illinoian till plain. Much of the surface is blanketed with loamy sediments of eolian origin. In places, sandy deposits are also present. Extensive deposits of eolian sand occur on the east and southeast side of the Cedar River in Black Hawk and Bremer Counties. County soil surveys refer to these features as dune like, although we choose to call them sand stringers to emphasize their low profiles. A GIS study using soil surveys produced several maps showing the distribution of the stringers, which display a strong northwest-southeast orientation (~310°). They typically rise 3-5 m above the surrounding Iowan Surface, have widths from 20-100 m, and can be traced for up to 20 km. The stringers are continuous across the landscape and in places, they have even blocked small drainageways and caused ponding and the formation of very poorly drained organic soils. Particle size analyses, study of sand surface textures, and other investigations are currently underway in an effort to better understand the characteristics of these sediments. The stringers appear to be very similar to features described from the Iowan Surface of southeastern Minnesota, where formation in a late Quaternary periglacial environment has been suggested.

#### **72. PRELIMINARY MAPS OF THE ST. PETER AND JORDAN FORMATIONS IN THE SUBSURFACE OF PORTIONS OF WINNESHIEK CO. IOWA**

J.N. Young

Luther College, Decorah, IA 52101

It has long been known that the base of the St. Peter formation represents an unconformity and that the Jordan formation displays subsurface structures in Allamakee County. This study uses well drillers' logs and analyzed well samples from the Iowa Geological Survey to map the top St. Peter, base St. Peter, thickness St. Peter and top Jordan.

The upper and especially the lower surfaces of the St. Peter turned out to be much more complex than originally thought. In particular, a large amount of anomalous material replaces part or all of the Prairie du Chien group under Decorah. The top Jordan map shows some domes similar to those in Allamakee County as well as the probable location of a fault previously described from a well in Decorah. This fault may be related to the anomalous feature in the St. Peter. There is some evidence for a second fault in a nearby deep well in Decorah.

The anomalous feature at the base of the St. Peter has been suggested to represent a cave fill or some fault-related structure such as a graben or half graben. The fact that these anomalous materials replace not only the Prairie du Chien carbonates but some of the Upper Cambrian sandstones argues for the latter interpretation.

#### **ORAL PRESENTATIONS**

#### **73. PRELIMINARY GEOCHEMICAL ANALYSIS OF CORALS FROM THE NEOGENE GURABO FORMATION, DOMINICAN REPUBLIC**

R.F. Denniston

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

Initial investigations into the degree of diagenetic alteration of coral specimens (*Goniopora hilli*) from the Neogene Gurabo formation, Dominican Republic, suggest that some samples are largely pristine. A combination of X-radiography, X-ray diffraction, thin section petrography, and stable isotopic analysis demonstrate the presence of well-defined growth banding, a predominance of primary aragonite with only scarce calcite or aragonite cements, significant primary porosity, preservation of fine-scale coral structures, and sinusoids in both carbon and oxygen stable isotopic ratios corresponding to an individual growth band. Absent the geochemical overprinting inherent in recrystallization, these corals may be utilized to extract sea surface temperatures and salinities via paired oxygen isotope and Sr/Ca ratios.

#### **74. THE INS AND OUTS OF THE CRETACEOUS DAKOTA FORMATION OF IOWA: FLUVIAL-ESTUARINE CYCLES OF THE KIOWA-SKULL CREEK MARINE TRANSGRESSION**

G.A. Ludvigson, B.J. Witzke, T.S. White, and R.L. Brenner  
Iowa Geol. Survey & Dept. Geoscience, University of Iowa, Iowa City, IA 52242

Sea-level rise during the Late Albian Kiowa-Skull Creek marine cycle (~100 Ma), completed Cretaceous connections between southern Tethyan and northern Boreal seas across the North American Western Interior. Westward-draining paleovalleys incised in Iowa and Nebraska developed more than 80 m of relief. During marine flooding, extremely low gradients in cratonic paleovalleys (estimated at 0.3-0.6m/km) and high rates of fluvial discharge promoted deposition in estuaries that extended over 400 km eastward from the transgressing shoreline. Deposition of estuarine mudrocks was coeval with aggradation of proximal fluvial conglomeratic sandstones in the basal Nishnabotna Mbr of the Dakota Formation. These facies intertongue along the Nebraska-Iowa border. Estuarine mudrocks of the Kiowa-Skull Creek cycle are distinguished by: (1) tidal rhythmites; (2) early pyrite cementation; (3) sparse marine ichnotaxa; (4) marine palynomorphs; (5) carbonaceous units (0.1-2.25 % TOC) with hydrogen indices ranging between 500-1,000; and (6) C/S ratios less than 5. Successive coarsening-upward fluvial-estuarine cycles in this interval are expressed (1) burrowed IHS sets (more proximal tidal point bars?), (2) distinctive gamma-ray log patterns, and (3) high HI values associated with marine flooding surfaces. These successive cycles backstepped upgradient during marine transgression.

Inspire future scientists,  
next year volunteer to be a judge  
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## 75. PERMIAN-TRIASSIC BOUNDRY INTERVAL IN THE SOUTHERN ALPS (TESERO AND BULLA SECTIONS, NORTHERN ITALY)

J.R. Groves<sup>1</sup>, M.D. Boyce<sup>1</sup>, B.J. Craig<sup>1</sup>, and R. Rettori<sup>2</sup>

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The Permian-Triassic (P-T) boundary in the Southern Alps falls within a conformable sequence of shallow marine carbonates assigned to the Tesero Oolite Member of the Werfen Formation. The Tesero Oolite Member overlies the Bulla Member of the Bellerophon Formation, and is overlain by the Mazzin Member of the Werfen Formation.

The P-T boundary at the Tesero and Bulla localities is identified on the local appearances of *Isarcicella changxingensis* and *Hindeodus parvus*. This level nearly coincides with the abrupt extinction of foraminifers and associated marine invertebrates that has been linked with elevated levels of CO<sub>2</sub>. Beds immediately above this horizon are variably oolitic and stromatolitic. These lithologies represent a sedimentologic response to the end-Permian mass extinction; i.e., development of biofilms in absence of grazing and bioturbating benthos; calcification of biofilms and inorganic precipitation of ooids as a consequence of elevated CO<sub>2</sub>. Lower Triassic stromatolites and oolites are a recurring facies association that has been recognized throughout the Tethyan region.

## 76. COMPLETION OF THE DIGITAL MAPS OF THE BEDROCK GEOLOGY AND TOPOGRAPHY OF SOUTHWEST AND EAST-CENTRAL IOWA: PHASES 5 & 6 OF THE STATEMAP IOWA BEDROCK MAPPING PROGRAM

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In the Summer of 2003 staff geologists at the Iowa Geological Survey (IGS) completed work on the Digital Maps of Bedrock Geology and Topography for 18 counties in Southwest and East-Central Iowa. Completion of these projects, Phases 5 & 6 of the Iowa Digital Bedrock Mapping Project supported in part by the USGS STATEMAP Geologic Mapping Program, brings the total of Iowa counties completed to 83. 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 in this region is the effects of the Thurman-Redfield Fault Zone, major reinterpretations of the distribution of Pennsylvanian and Cretaceous strata in the region, and a more accurate

delineation of the limits of the Early Pleistocene Fremont Bedrock Channel. The bedrock of the East-Central study area is dominated by Devonian, Mississippian, and Pennsylvanian strata. Resolution of the complex Mississippian stratigraphy was a major challenge in this mapping region.

## PHYSICS SECTION

### ORAL PRESENTATIONS

#### 77. PHYSICS OF POTASSIUM ION CHANNEL INACTIVATION IN NEURONS

R.M.W. Collins and C.C. Chancey

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The electrical signaling capabilities of neurons depend on the flows of ions into and out of their axons. Potassium ions exit an axon's interior through a potassium channel or pore that connects the intracellular region with the extracellular region. The channel opens, or is activated, allowing potassium ions to exit. The channel then undergoes a blocking transition in which the channel is physically open but is blocked by some part of the larger channel molecular. This blocking process is called inactivation, and the physics by which it might occur forms the topic of our investigation. The N-terminus region of the *Drosophila* shaker potassium ion channel was identified by Hoshi et al as having an important role in channel inactivation. Using the last 19 amino acids in the N-Terminus region, a mass and net charge were calculated. We investigated two forces that might affect the motion of this N-terminus mass (tentatively identified as the blocking or inactivation particle): the magnetic field effects due to potassium ion current in the channel, and an electric force due to the decreasing density of potassium ions from the intracellular region. Time-of-flight calculations were calculated for the inactivation particle. These times will be discussed in terms of typical inactivation processes.

#### 78. USING EXCEL TO SIMULATE A GEIGER COUNTER

Thomas C. Gibbons

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It is possible to use the Excel spreadsheet for simulations of various physics experiments and demonstrations that might otherwise prove expensive, difficult, or dangerous, or at least be perceived as dangerous. One such area is student labs and demonstrations in the field of radioactivity. For this purpose, I have used the Excel to create a simulated Geiger counter that can preserve the random nature of radioactivity by using the random number generator (RAND function).

Two or three forms of this simulation will be demonstrated. One such form is designed for simulated half-life determinations. The instructor can vary the half-life, and students can use the simulations at individual computers to determine the number of counts after various time intervals.

Another form can remove all sources to count the background, which is included in the subsequent counting by students. A third form can use data contained within the spreadsheet to simulate the effects of various absorbers on gamma rays of various energies. All of these have allowed a greater range of student labs than we could have managed otherwise.

## **79. VALUE ADDED! QUANTIFYING THE AMOUNT OF ENERGY SAVED BY RECYCLING**

Patricia Higby and Zhong-Guang (Tony) Fang  
Center for Energy & Environmental Education, University of Northern Iowa, Cedar Falls, IA 50614

The energy required to produce paper, plastics, glass, and metal from recycled materials is generally less than the energy required to produce them from virgin feedstocks. This indicates a substantial "value added" component of energy conservation to the commonly recognized benefits of recycling. Because of rising cost and pollution from energy use, the energy saved by recycling is becoming more and more important. The objective of our research is to calculate the amount of energy saved by recycling.

Recent research and reports regarding the energy benefit of recycling, based on current manufacturing and recycling technologies, are comprehensively reviewed. Data that include the tons of various recycled materials and per ton energy saved by recycling each of these materials are used to calculate the total energy saved. Values are calculated for typical households in various Iowa communities and the state as a whole.

## **80. MODELING THE ACTIVATION OF MECHANISM OF POTASSIUM CHANNELS NEURONS**

Kevin A. Twedt and C.C. Chancey  
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We have modeled the electrostatic interaction between the S4 segment of the potassium channel molecule and the surrounding water molecules on both the intracellular and extracellular sides of the neural axon cell membrane. Two methods were used to approximate this interaction: (i) a macroscopic evaluation in which the water was treated as a dielectric medium with dielectric constant 80; (ii) a microscopic evaluation considering the effects of each individual water molecule fixed in position within the water pockets surrounding the S4 segment. The potential energy of the S4 due to the water pockets was plotted against rotation of the S4 segment, while keeping the water pockets in their fixed positions. Although the two methods gave some differing results, both methods produced single well potential energy curves of ~6-9 eV depth. Based on this energy curve, we show that other forces on the S4 must create an effective torsional spring force with spring constant  $k \sim 3-5$  eV in order to produce a two-well potential energy curve in qualitative agreement with experimental data.

## **PHYSIOLOGY SECTION**

### **POSTERS**

#### **81. EFFECT OF DATA SAMPLING RATE ON ACCURACY OF HEART RATE VARIABILITY INDICES**

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Heart rate variability (HRV) indices are very sensitive predictors for cardiovascular morbidity and mortality. To calculate these indices a heart rate time series need to be derived from ECG or blood pressure recordings. The aim of this study was to determine the lowest sampling rate for arterial blood pressure that will allow estimation of heart rate variability with reasonable accuracy in rats.

Rats ( $n=11$ ) were chronically instrumented with arterial catheters and ECG electrodes. After 24h recovery, arterial blood pressure and ECG were recorded in conscious rats using a sampling rate of 1000 Hz. The original 1000 Hz data files were resampled at 500 Hz, 333 Hz, 250 Hz, 200 Hz, 100 Hz, and 50 Hz. Heart rate time series were derived from the 1000 Hz ECG signals and the blood pressure time series at different sampling rates. From these heart rate time series, the variance of the heart rate was calculated as index of HRV.

Heart rate variance derived from arterial blood pressure sampled at sampling rates lower than 100 Hz differed significantly from that obtained from the 1000 Hz ECG time series. In conclusion, blood pressure in rats needs to be sampled only with 100 Hz in order to derive heart rate variance with reasonable accuracy.

#### **82. CONTRIBUTION OF SYMPATHETIC NERVE ACTIVITY AND VASCULAR SYMPATHETIC RESPONSIVENESS TO SYMPATHETIC-MEDIATED BLOOD PRESSURE MAYER WAVES**

A Gericke and H.M. Stauss

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The contribution of neuronal sympathetic activity and vascular sympathetic responsiveness to sympathetic-mediated blood pressure Mayer waves was investigated in spontaneously hypertensive rats (SHR,  $n=8$ ), normotensive Wistar Kyoto rats (WKY,  $n=8$ ), and 1-clip, 2-kidney renal hypertensive WKY (1C2K,  $n=10$ ). Five weeks following renal artery clipping mean blood pressure (BP) was higher in 1C2K ( $130 \pm 8$  mmHg) and SHR ( $136 \pm 3$ ) compared to WKY ( $108 \pm 2$ ). Low-frequency (LF: 0.2-0.6 Hz) spectral power of BP (Mayer waves) was larger in SHR ( $17.4 \pm 1.3\%$ ) than in WKY ( $12.1 \pm 1.4\%$ ,  $p < 0.05$ ) and larger than WKY than in 1C2K ( $6.3 \pm 0.9\%$ ). LF spectral power of splanchnic sympathetic nerve activity was larger in SHR ( $13.5 \pm 2.0\%$ ) than in WKY ( $9.8 \pm 1.3\%$ ) and 1C2K ( $8.6 \pm 0.8\%$ ), indicating increased sympathetic nerve activity in SHR. Contractile responses of pressurized mesenteric arterioles to

norepinephrine (NE) and phenylephrine ( $10^{-8}$  to  $10^{-4}$ M) were greater in SHR (NE  $10^{-5}$ M:  $91\pm 2\%$ ) and WKY (NE  $10^{-5}$ M:  $82\pm 14\%$ ) than in 1C2K (NE  $10^{-5}$ M:  $38\pm 7\%$ ), indicating reduced vascular sympathetic responsiveness in 1C2K. In conclusion, low frequency blood pressure power at the frequency of Mayer waves depends on both, sympathetic nerve activity and vascular sympathetic responsiveness.

### **83. OXIDATIVE STRESS CONTRIBUTES TO INCREASED SYMPATHETIC VASOMOTOR TONE AND DECREASED BAROREFLEX SENSITIVITY IN HYPERTENSIVE AND HYPERCHOLESTEROLEMIC MICE**

E. Lazartigues, C.A. Whiteis, N. Maheshwari, F.M. Abboud, H.M. Strauss, R.L. Davison, and M.W. Chapleau  
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We hypothesized that oxidative stress impairs autonomic function and baroreflex sensitivity (BRS) in mice (<15wks) with hypertension (HT) and hypercholesterolemia (HC). Blood pressure (BP) and heart rate were measured by telemetry in conscious renin-angiotensinogen transgenic mice with HT ( $R^{+A^{+}}$ ,  $155\pm 6$  mmHg,  $n=4$ ), apoE null mice with HC (apoE $^{-/-}$ ,  $100\pm 12$  mmHg,  $n=3$ ),  $R^{+A^{+}}$  apoE $^{-/-}$  mice with HT and HC ( $144\pm 3$  mmHg,  $n=4$ ) and control mice ( $114\pm 4$  mmHg,  $n=4$ ). Low frequency (LF) BP variability (spectral analysis) corresponding to sympathetic vasomotor tone was increased  $R^{+A^{+}}$ , apoE $^{-/-}$ , and  $R^{+A^{+}}$  apoE $^{-/-}$  mice ( $14\pm 4$ ,  $10\pm 4$ ,  $12\pm 5$  mmHg $^2$ ) vs. controls ( $1.2\pm 0.3$  mmHg $^2$ ,  $P<.05$ ). Spontaneous BRS (sequence method) was significantly decreased in  $R^{+A^{+}}$ , apoE $^{-/-}$ , and  $R^{+A^{+}}$  apoE $^{-/-}$  mice ( $1.0\pm 0.1$ ,  $1.2\pm 0.2$ ,  $1.1\pm 0.2$  ms/mmHg) vs. controls ( $2.5\pm 0.4$  ms/mmHg,  $P<.05$ ). Administration of the antioxidant tempol in drinking water (1wk) did not alter BP but reduced LF BP variability in the HT/HC groups (eg,  $2.5\pm 0.5$  mmHg $^2$  in  $R^{+A^{+}}$  apoE $^{-/-}$ ), and restored BRS in  $R^{+A^{+}}$  and apoE $^{-/-}$  mice ( $1.6\pm 0.2$  and  $1.7\pm 0.3$  ms/mmHg). We conclude: 1) HT or HC alone increase sympathetic vasomotor tone and decrease BRS, 2) the combination of HT.

### **84. ACTIVITY-DEPENDENT "RESETTING" OF BARORECEPTOR AND VAGAL AFFERENT NEURONS MEDIATED BY HYDROGEN PEROXIDE/HYDROXYL RADICAL**

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Baroreceptors (BR) adapt and "reset" during sustained increases in blood pressure (BP) *in vivo*. We hypothesized that reactive oxygen species (ROS) generated during sustained action potential (AP) firing of BR neurons cause "resetting" by inhibiting membrane excitability. Membrane potential was recorded by sharp microelectrodes in BR and vagal afferent neurons isolated from rat and mouse nodose ganglia. "Conditioning" the neurons for 1 min with

depolarizing current pulses (20 Hz) generated ROS (TEMPO-9-AC fluorescence,  $n=7$ ) and inhibited excitability (AP response to 1s depolarizing current injection,  $n=14$ ). Excitability averaged  $15\pm 3\%$  of control  $\sim 1$ s after stimulation and recovered to  $119\pm 21\%$  5 min later. Addition of membrane permeable superoxide dismutase (PEG-SOD) to decrease superoxide enhanced the ROS signal and prolonged the activity-dependent inhibition of excitability ( $15\pm 3$  and  $34\pm 11\%$  at 1s and 5 min,  $n=7$ ). In contrast, addition of PEG-catalase to decrease hydrogen peroxide ( $H_2O_2$ ) abolished the ROS signal and the inhibition of excitability ( $92\pm 18$  and  $127\pm 31\%$  at 5s and 5 min,  $n=6$ ). We conclude that sustained activation of BR and vagal afferent neurons generates ROS and inhibits membrane excitability.  $H_2O_2$ /hydroxyl radical mediates the inhibition. This mechanism may contribute to BR resetting during acute hypertension.

## **PSYCHOLOGY & LINGUISTICS SECTION**

No Posters or Papers

## **SCIENCE TEACHING SECTION**

### **POSTER**

### **85. iBENCH: INSTRUCTION IN BASIC EQUIPMENT NEEDED FOR CHEMISTRY & BIOLOGY**

M. Dean, D. Fraga, W. Morgan, L. Stroschine, and T. Tauer  
Coe College, 1220, 1<sup>st</sup> Ave. NE, Cedar Rapids, IA 52402 and The College of Wooster, 1189 Beall Ave., Wooster OH, 44691

Introductory chemistry and biology students typically have little experience with the equipment they will be using in the college laboratory. A pre-lab instructional activity that actively engages students will allow students to make more effective use of scheduled time in the lab. Properly designed computer modules are an ideal method for learning about and "virtually practicing" with new equipment. Unfortunately, current computer-based instructional activities in this area fail to intellectually engage students. We are developing a suite of online modules, called iBench, which will introduce students to relevant concepts and equipment before entering the biology/chemistry laboratory. These modules are designed to be intellectually, as well as physically, interactive and allow students to "virtually practice" with pieces of laboratory equipment. These modules will have been tested internally, improved, and distributed for beta testing among interested colleagues at other institutions. We will present key information on our finished module on micropipettes, student feedback from alpha and beta testing, and our progress with other iBench modules.

## ZOOLOGY SECTION

### POSTERS

#### 86. PREDATION AND ECOLOGY OF NESTING ORNATE BOX TURTLES

C.L. Barker, J.M. Wallace, J. Pisarik, J. Gohdes, Monica Goncze, N. Hennings, R.W. Black, S.A. McCollum, and N.P. Bernstein

Mount Mercy College (Cedar Rapids, IA) and Cornell College (Mount Vernon Iowa)

The nesting habits of ornate box turtles were studied with attention to the predation rate. Every night from late May to the third week in June, 20 radio transmitted female turtles were located to determine their position, habitat, and whether they were nesting. Location data were transferred to ArcView GIS based upon GPS readings from the field. If a nesting female was found, the location and habitat of the nest was recorded, and the nest was marked. On subsequent days, the fate of the nest was monitored. Data were also taken on the distance of the nest from the edge, the coverage (categories based upon a densiometer), and the slope of the land.

At any one time, up to eight females entered a soybean field and were not followed. Of the remaining females, three built nests and laid eggs. The eggs from these nests were dug up and predated within 12-24 hours. The predominant habitat used at this time was open sand prairie or the shrubs alongside the open sand prairie. Nests were laid in areas with no coverage of vegetation above, between 15-29 m from the nearest vegetational edge, and on a slope between 0-25 degrees. From our preliminary study, nest predation is high in this area, and open sand prairie habitat is important to turtle nesting.

#### 87. POTENTIAL FISH HABITAT MATERIALS: A COMPARISON OF EFFECTIVENESS BASED ON INVERTEBRATE COLONIZATION

E.C. Cherko, T.W. Stewart, C.L. Pierce, and D.D. Stokke  
Department of Natural Resource Ecology and Management,  
Iowa State University, Ames, IA 50011

Pure Fishing®, an Iowa-based fishing tackle company, is constructing habitat from recycled polyethylene fishing line. Used line is being converted into large strips, and aggregations of this material will soon be submerged in Iowa lakes to provide structure for fish and their macroinvertebrate prey. We quantified macroinvertebrate colonization of basic polyethylene, physically and chemically modified polyethylene, and natural wood to assess habitat value of alternative substrata.

Representative samples of seven substratum types (n = 3 replicates per treatment) were placed in Spirit Lake, Dickinson County, Iowa, and retrieved after 28 days. Total dry weight (g/m<sup>2</sup>) of macroinvertebrates did not differ among treatments (p = 0.63). However, an abundance of amphipods, invertebrates known to be important fish prey, was at least three time greater on a substratum composed of dribbled switchgrass flour and recycled fishing line (RSD treatment) than in any other treatment (ANOVA, p = 0.072). RSD substrata had irregular surfaces, and were far more structurally complex than substrata in other treatments. Positive responses of amphipods to RSD substrata were likely attributed to abundant crevices that were colonized by these invertebrates. To maximize attractiveness of habitat to fish and their prey, we recommend physicochemical modifications of basic polyethylene to produce habitats with structurally complex surfaces.



United States Geological Survey



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## ORAL PRESENTATIONS

### 88. AGRICULTURAL PONDS SUPPORT AMPHIBIAN POPULATIONS

Melinda Knutson<sup>1</sup>, William Richardson<sup>1</sup>, David Reineke<sup>2</sup>, Brian Gray<sup>1</sup>, Jeffery Parmelee<sup>3</sup>, Shawn Weick<sup>1</sup>

<sup>1</sup>U.S. Geological Survey, Upper Midwest Environmental Sciences Center, 2630 Fanta Reed Rd., La Crosse, WI 54603, <sup>2</sup>University of Wisconsin-La Crosse, Department of Mathematics, 1725 State St., La Crosse, WI 54601, <sup>3</sup>Simpson College, Department of Biology, 701 North C Street, Indianola, IA 50125

In some agricultural regions, natural wetlands are scarce and constructed agricultural ponds may represent important alternative breeding habitats for amphibians. We studied small, constructed agricultural ponds in southeastern Minnesota to assess their value as amphibian breeding sites. Our study examined habitat factors associated with amphibian reproduction at two spatial scales: the pond and the landscape surrounding the pond. We found that small agricultural ponds in southeastern Minnesota provided breeding habitat for at least ten species of amphibians. Species richness and multi-species reproductive success were more closely associated with characteristics of the pond (water quality, vegetation, and predators) compared with characteristics of the surrounding landscape, but individual species were associated with both pond and landscape variables. Ponds surrounded by row crops had similar species richness and reproductive success compared with natural wetlands and ponds surrounded by non-grazed pasture. Ponds used for watering livestock had elevated concentrations of phosphorus, higher turbidity, and a trend toward reduced amphibian reproductive success.

### 89. ECOLOGY OF THE EASTERN MASSASAUGA RATTLESNAKE IN IOWA

T.J. Van DeWalle

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The eastern massasauga rattlesnake is listed as endangered in Iowa and is a Candidate Species for listing as threatened by the USFWS. An understanding of the massasauga's habitat utilization and spatial ecology is necessary for developing management recommendations for the four remaining Iowa populations. In 2002, a radio telemetry study was initiated in Bremer County along the Upper Wapsipinicon River to determine home range size and habitat preferences of massasaugas in Iowa.

On average, males had the largest total home range and the largest core areas when compared to both gravid and nongravid females. Among the females, nongravid females had the largest home range and core area size. Males moved more frequently and made longer daily movements than either gravid or nongravid females. Massasaugas in the study area are utilizing both wetland and upland habitats throughout the year. Snakes were caught most frequently in wet prairie areas with a diverse vegetation community and

in an upland field dominated by big bluestem and switchgrass. Both wet and dry road ditches are utilized heavily by massasaugas. In addition, use of cropfields was documented. I thank the Iowa DNR and the USFWS for funding the study.

### 90. TEMPERATURES OF WINTERING ORNATE BOX TURTLES

N.P. Bernstein and R.W. Black

Mount Mercy College (Cedar Rapids, IA) and Cornell College (Mount Vernon, IA)

Nine ornate box turtles were equipped with temperature dataloggers and radio transmitters in September, 2002. Both dataloggers and transmitters were affixed to the carapace, and the dataloggers recorded temperature every 3 hours to the nearest 0.5°C. Turtles and dataloggers were recovered in April after emergence from hibernation.

Seven turtles maintained a temperature above freezing, but two turtles experienced below freezing temperatures for extended periods of time. Emergence from overwintering did not correspond with the concept that 48 hours of temperatures above 7°C was necessary as reported in the literature.

### 91. ESTIMATING AGE OF VERY OLD BOX TURTLES

B.P. Rinner, D. Courard-Hauri, and J.L. Christiansen

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No method currently exists for estimating the age of very old field-caught box turtles. We used a combination of counts of plastral annulae and mark recapture studies to establish ages for ornate box turtles up to 40 years old. Comparison of ages indicated by recaptures with plastral annular counts enabled us to evaluate the declining accuracy of plastral annular counts with turtles of increasing age. This led to the conclusion that such counts are nearly valueless in ornate box turtles older than 25 years. We examined increasing deviation from linearity of the central plastral suture and increasing depth of the anterior plastral lobe hinge in known age turtles to develop a curve estimating these parameters in old turtles. Our observations suggest that anterior hinge depth is a less variable and more accurate estimator of turtle age than is medial suture deviation. They indicate that a log curve is the best estimator of change with age. Application of this technique to turtles of unknown age indicates that ornate box turtles may live as long as 100 years in Iowa.

The Iowa Science Teacher's Section (ISTS)  
Fall Conference is the state's largest  
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Plan to present or attend: October 21, 2004

## Index of Contributing Authors (by Abstract Number)

|                          |          |                 |          |                    |           |                    |        |
|--------------------------|----------|-----------------|----------|--------------------|-----------|--------------------|--------|
| Abboud, F.M.             | 83, 84   | Dubbert, S.     | 9        | Ludvigson, G.A.    | 74, 76    | Trenkle, A.H.      | 1      |
| Abdel-Malek, K.A.        | 43       | Edwards, H.     | 19, 31   | Maheshwari, N.     | 83        | Twedt, K.A.        | 80     |
| Ahmed, A.                | 57       | Escalada, L. T. | 33       | Manfredi, K.       | 20        | Uzoigwe, J.        | 62     |
| Ames, R.P.               | 25       | Essmann, M.     | 18       | Mayes, M.S.        | 16        | Van DeWalle, T.J.  | 89     |
| Anderson, L.L.           | 16       | Fang, Z.G.      | 79       | McCleary, A.L.     | 30        | Vecchi, B.         | 7      |
| Anderson, R.R.           | 76       | Fatland, S.     | 17       | McCollum, S.A.     | 86        | Vengasandra, S. G. | 27     |
| Andrews, C.              | 21       | Fields, C.L.    | 66       | McCormick, L.      | 40        | Vidal, L.          | 18     |
| Antoniou, A.             | 56       | Fraga, D.       | 85       | McCullough, D.A.   | 39        | Vogel, J.          | 58     |
| Bahadur, S.              | 57       | Fritsch, B.     | 24       | Miller, A. A.      | 26        | Volmer, B.C.       | 48     |
| Bailey, T.B.             | 10, 12   | Gallant, A. L.  | 38       | Moeller, J.        | 33        | Wallace, C.        | 50     |
| Barker, C.L.             | 86       | Garvey, L. C.   | 26       | Morgan, W.         | 85        | Wallace, J.M.      | 86     |
| Bartak, D.E.             | 68       | Gericke, A.     | 82       | Muhle, E.D.        | 51        | Walters, J.        | 71     |
| Bartels, B. L.           | 26       | Gerrath, J.M.   | 9        | Nettikandan, S. R. | 27        | Watson, A.         | 19, 31 |
| Bartelt, P.E.            | 38       | Gibbons, T.C.   | 78       | Nimbalkar, D.      | 22        | Weick, S.          | 88     |
| Bastawros, A.F.          | 56       | Gohdes, J.      | 86       | O'Brien, E.H.      | 64        | Weins, D.          | 20     |
| Becker, J.J.             | 68       | Goncze, M.      | 86       | Onck, P.R.         | 56        | Wheelock, T.D.     | 46     |
| Beitz, D.C.              | 30       | Gorke, J.T.     | 46       | Ortiz-Perez, E.    | 11        | White, T.S.        | 74     |
| Beltz, L.A.              | 21       | Gossett, S.     | 4        | Palmer, R.G.       | 10,11,12  | Whiteis, C.A.      | 83, 84 |
| Bera, F.                 | 69       | Gray, B.        | 88       | Parmelee, J.       | 88        | Wipf, T.J.         | 52     |
| Bernstein, N.P.          | 86, 90   | Greimann, L.F.  | 52       | Pasker, R.         | 63        | Witzke, B.J.       | 74, 76 |
| Bhatia, V.               | 81       | Groves, J.R.    | 75       | Perry, M.J.        | 8         | Xiao, S.P.         | 59     |
| Black, D.W.              | 51       | Haan, F.L.      | 49       | Phares, B.M.       | 52        | Yang, Y.           | 58     |
| Black, R.W.              | 86, 90   | Hage, D. S.     | 29       | Pickett, L.        | 55        | Yermolaieva, O.    | 84     |
| Bohan, M.M.              | 1, 30    | Hammond, E.     | 30       | Pierce, C.L.       | 87        | Young, C.          | 23     |
| Bonte, J. L.             | 32       | Harken, J.      | 36       | Pisarik, J.        | 86        | Young, J.N.        | 72     |
| Bowman, J.               | 50       | Healy, M.       | 20       | Porumamilla, H.    | 53        | Zhang, S.          | 30     |
| Boyce, M.D.              | 75       | Healy, R.A.     | 10,12,40 | Quelle, F. W.      | 22        | Zhou, X.           | 45     |
| Brands, E.               | 60       | Hemphill, D.J.  | 52       | Reineke, D.        | 88        |                    |        |
| Brenner, R.L.            | 74       | Hemsath, C.     | 34       | Reiter, W. S.      | 29        |                    |        |
| Briggs, D.               | 19, 31   | Hennings, N.    | 86       | Rettori, R.        | 75        |                    |        |
| Brincks, R.              | 9        | Henry, M.K.     | 22, 23   | Richardson, W.     | 88        |                    |        |
| Brittingham, A.          | 25       | Higby, P.       | 79       | Rinner, B.P.       | 91        |                    |        |
| Brown, E.                | 62, 63   | Hohl, R.J.      | 22       | Rosburg, T.R.      | 14,15     |                    |        |
| Brown, R.C.              | 47       | Horner, H.T.    | 12, 13   | Sadaka, S.S.       | 47        |                    |        |
| Brumm, R.                | 34       | Hulse, R.       | 61       | Sandler, R.        | 5         |                    |        |
| Bunker, B.J.             | 76       | Jackson, L.     | 35       | Sarkar, P.P.       | 49        |                    |        |
| Carolan, A.              | 35       | Jena, B.P.      | 16       | Satrio, J.A.       | 48        |                    |        |
| Casas, K.                | 2        | Johnson, J.C.   | 26,27    | Schmerr, Jr., L.W. | 54        |                    |        |
| Cervantes-Martinez, I.G. | 11       | Johnson, L.A.   | 70       | Schmidt, M.        | 24        |                    |        |
| Cervantes-Martinez, T.   | 12       | Jurgenson, J.   | 41, 42   | Schueller, M.D.    | 65        |                    |        |
| Chancey, C.C.            | 77, 80   | Kelkar, A.G.    | 53       | Schwemm, A.        | 63        |                    |        |
| Chapleau, M.W.           | 83, 84   | Klaver, R. W.   | 38       | Scolaro, E.        | 25        |                    |        |
| Cherko, E.C.             | 87       | Klein, C.A.     | 51       | Seigley, L.S.      | 64        |                    |        |
| Christiansen, J. L.      | 26,27,91 | Knutson, M.     | 88       | Skopec, M.P.       | 64        |                    |        |
| Clayton, M.              | 63, 68   | Koch, J.        | 71       | Sleister, H.       | 17        |                    |        |
| Collins, R.M.W.          | 77       | Kracher, A.     | 28       | Smeenk, J.L.       | 47        |                    |        |
| Conley, A.               | 33       | Krueger, H.M.   | 67       | Snitsarev, V.      | 84        |                    |        |
| Cook, M.                 | 50       | Kruse, F.       | 42       | Sonon Jr., R.N.    | 1         |                    |        |
| Courard-Hauri, D.        | 91       | Kruse, M.A.     | 65       | Stauss, H.M.       | 81,82, 83 |                    |        |
| Craig, B.J.              | 75       | Kumar, S.       | 44       | Steichen, R. M.    | 37        |                    |        |
| Czarnetzki, A.C.         | 69       | Larsen, B.      | 18       | Stewart, T.W.      | 87        |                    |        |
| Davis, S.                | 3        | Lazartigues, E. | 83       | Stokke, D.D.       | 87        |                    |        |
| Davison, R.L.            | 83       | Leavitt, G.     | 50       | Stromer, M.H.      | 16        |                    |        |
| Dayal, V.                | 55, 58   | Lee, J-S        | 16       | Storm, J.          | 18        |                    |        |
| Dean, M.                 | 19,31,85 | Leeson S.       | 17       | Stroschine, L.     | 85        |                    |        |
| Denniston, R.F.          | 73       | Lersten, N.     | 13       | Sugumaran, R.      | 36        |                    |        |
| DeVries, R.              | 41       | Lewis, M.N.     | 37       | Summerville, K. S. | 37        |                    |        |
| Dhanwada, K.R.           | 20,67,68 | Lovan, S        | 26, 27   | Swanson, J         | 6         |                    |        |
| Diehl, T.M.              | 48       | Lovell, P.M.    | 15       | Tauer, T.          | 19, 31,85 |                    |        |
| Doornink, J.D.           | 52       | Lu, J.          | 45       | Tiffany, L.H.      | 40        |                    |        |

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