

2005


117th Annual Meeting of the Iowa Academy of Science [Program, 2005]

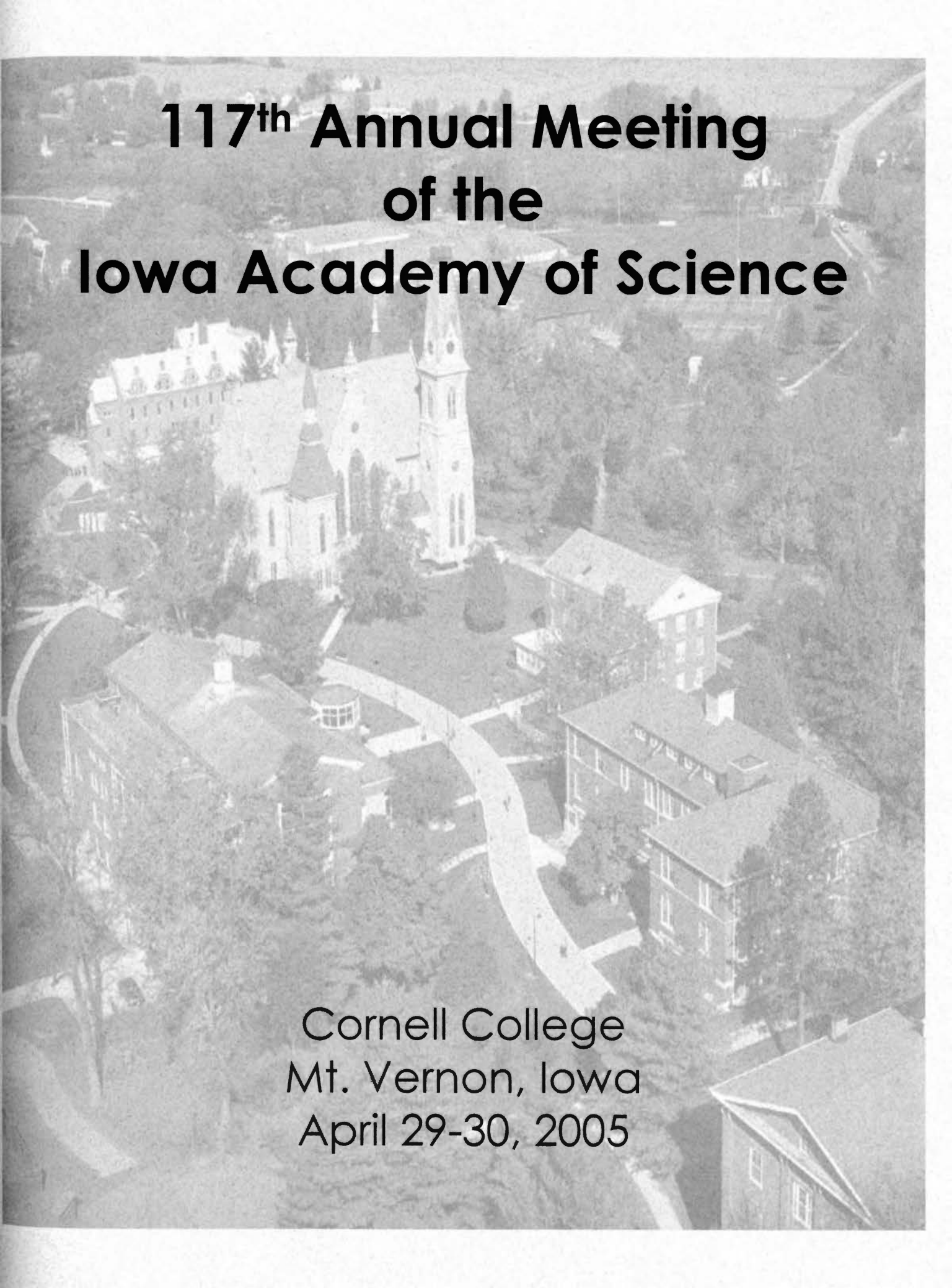
Iowa Academy of Science

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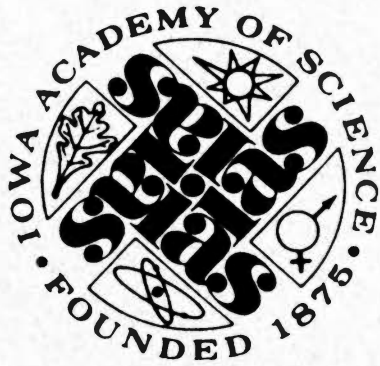
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**117th Annual Meeting
of the
Iowa Academy of Science**

Cornell College
Mt. Vernon, Iowa
April 29-30, 2005



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Iowa Academy of Science

175 Baker Hall – UNI
Cedar Falls, Iowa 50614
319-273-2021
<http://www.iacad.org>

Tri-Beta

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

Special Thanks

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

Cornell College
Epsilon Iota chapter of Tri Beta
Iowa Geological Survey
USGS, Iowa District
Rockwell Collins
Pella Rollscreen Foundation

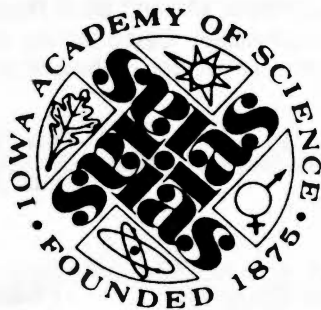
All of the 2005 IAS Officers, section chairs, vice chairs, committee members, speakers, and other volunteers.

**Rockwell
Collins**



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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.

Affiliated with the American Association for the Advancement of Science (AAAS), the National Science Teachers Association (NSTA), the American Junior Academy of Sciences (AJAS) the Iowa Space Grant Consortium (ISGC) and the Iowa Mathematics and Science Coalition (IMSC).

Friday Program Summary

April 29th, 2005

Time	Activity	Location
7:30-8:00	Registration Desk open for IJAS Only	1st Floor, Commons
8:00-11:45	Registration Desk Open	1st Floor, Commons
8:00-8:30	IJAS Poster Set-up	1st Floor, Commons
8:00-12:00	USGS Booth	1st Floor, Commons
8:00-11:00	Continental Breakfast	Kimmel Atrium
8:30-11:00	IJAS Poster Session	1st Floor, Commons
8:30-10:50	IJAS Oral Presentations	Martin Luther Room & Berlin Room, Basement, Commons
11:00-12:00	General Session I The Cassini Mission to Saturn, Donald A. Gurnett, Ph. D.	Kimmel Theatre
12:00-1:30	Awards Luncheon	Dinning Hall
1:30-5:00	Registration Desk Open	1st Floor, Commons
1:45-2:30	Standing Committee Meetings Committee on Committees and Elections, Magee Room, B Conservation and Preserves, Beijing Room, B Finance Committee, Paris Room, B Iowa Science Foundation, Stockholm Room, B Membership Committee, Hedges Room, 1 Recognition and Awards, Athens Room, B Societal Issues Committee, Martin Luther Room, B Student Programs Committee, Berlin Room, B All Rooms are in Commons. (1 = 1st floor, B = Basement)	
2:00-5:00	General Poster Session Set-Up	1st Floor, Commons & Kimmel Atrium
2:30-3:00	IAS Business Meeting	Hedges Room – 1st Floor, Commons
3:15-5:00	Symposia (see page 65) A. Ecology of Overlooked Landscapes B. Past, Present, and Future Investigations on Water-Quality Issues in Iowa C. Geologic Contributions to Archaeological Method and Theory	Hedges Room – 1st Floor, Commons Martin Luther Room – Basement, Commons Shaw Room – 1st Floor, Commons
5:00-6:00	Social Hour	1st Floor Commons & Kimmel Atrium
5:00-6:00	General Poster Session	1st Floor Commons & Kimmel Atrium
6:00-7:30	President's Banquet	Dinning Hall
8:00-9:30	General Session II America's Lost Landscape: The Tallgrass Prairie, Dr. Daryl Smith	Kimmel Theatre

Saturday Program Summary

April 30th, 2005

Time	Activity	Location
8:00-12:00	Registration Desk Open	1st Floor, Commons
8:00-10:00	Special Poster Session Set-up	1st Floor, Commons
8:00-12:00	USGS Booth	1st Floor, Commons
8:00-11:00	Continental Breakfast	Kimmel Atrium
8:00-11:00	Section Meetings	See section meeting schedules (pages 13-18) for specific schedules and locations.
10:00-11:00	Cellular, Molecular and Microbiology Special Poster Session	1st Floor, Commons
11:00-12:00	General Session III The Science of Human and Animal Vocalization	Kimmel Theatre
12:00-1:30	Lunch	On Your Own
1:00-4:00	Section Meetings	Resume as necessary
3:00-3:30	Tri-Beta Regional Meeting and Award Ceremony	Hedges Room – 1st Floor, Commons
3:00-	Geology Society of Iowa Field Trip (see page 19)	Cedar Rapids Quarry, Linn County, Iowa

Iowa Academy of Science Annual Business Meeting

Open to all participants. Only IAS Members may vote.

Call meeting to order
 Recognition of deceased members and moment of silence
 Recognition of new fellows
 Executive Director Report
 Bylaws changes adoption vote
 Old Business
 New Business
 Conclusion

General Sessions

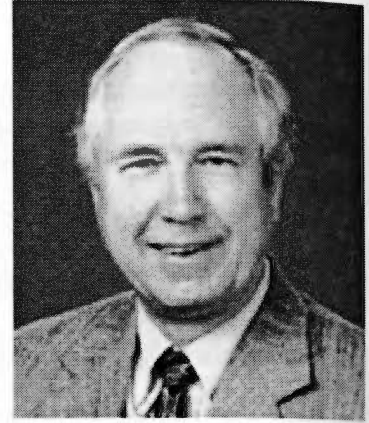
General Session I

The Cassini Mission to Saturn

Donald A. Gurnett, Ph.D.

Friday, April 29th, 11:00am

Kimmel Theatre, Open to the Public



On July 1, 2004, after a nearly seven-year journey, the Cassini spacecraft was placed in orbit around Saturn. In this talk Professor Gurnett will describe recent results from Cassini mission to Saturn. The presentation will include a discussion of spectacular images of Saturn, its rings, and its moons, particularly Titan, and the early results from the University of Iowa Instrument that is carried aboard the spacecraft.

IAS member Dr. Donald Gurnett started his science career by working on spacecraft electronics design as a student employee in The University of Iowa Physics Department in 1959. After completing his B.S. in electrical engineering at Iowa in 1962, he transferred to physics, where he received his M.S. and Ph.D. degrees in 1963 and 1965. He spent one year, from 1964 to 1965, as a NASA Trainee at Stanford University ; was appointed Assistant Professor at the University of Iowa in 1965 with subsequent promotions to Associate Professor and to Professor in 1968 and 1972. Since then he spent one year on leave as an Alexander Von Humboldt Senior Scientist at the Max-Planck-Institut in Garching , Germany , and one year on leave as a visiting professor at the University of California , Los Angeles .

Prof. Gurnett specializes in the study of space plasma physics and has participated in 25 spacecraft projects, most notably the Voyager 1 and 2 flights to the outer planets, the Galileo mission to Jupiter, and the Cassini mission to Saturn. He is the author or co-author of over 450 scientific publications, primarily in the area of magnetospheric radio and plasma wave research, and has supervised 50 M.S. and Ph.D. thesis projects. Prof. Gurnett has received numerous awards for his research. These include the 1978 John Howard Dellinger Gold Medal from the International Scientific Radio Union, the 1989 John Adam Fleming Medal from the American Geophysical Union and the 1989 Excellence in Plasma Physics Award from the American Physical Society. He regularly teaches both undergraduate and graduate courses in physics and astronomy, and in 1990 he received the M. L. Huit Faculty Award for outstanding service and dedication to students at the University of Iowa , and in 1994 he received the Iowa Board of Regents Award for Faculty Excellence. In 1998 he was elected a member of the National Academy of Sciences, and in 2004 he was elected a Fellow of the American Academy of Arts and Sciences.

This session sponsored by

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General Sessions

General Session II

America's Lost Landscape: The Tallgrass Prairie

Film Screening with Dr. Daryl Smith

Friday, April 29th, 8:00pm

Kimmel Theatre, Open to the Public

America's Lost Landscape: The Tallgrass Prairie is a sixty minute documentary film designed for national broadcast on public television. The film tells the story of one of the world's great ecosystems and its transformation from natural landscape to farmland. The tallgrass prairie was once a prominent feature of the North American Continent that was reduced, in less than a hundred years, to the vanishing point. The film is narrated by Iowa native, Annabeth Gish and includes commentary by Richard Manning, Pauline Drobney and many other regional scholars. America's Lost Landscape: The Tallgrass Prairie is a co-production of the University of Northern Iowa and New Light Media, Inc and directed by David O'Shields.



IAS member Daryl Smith, Ph.D., is the project director and executive producer of the Lost Landscape Film Project. Smith is a Professor of Biology and Science Education at the University of Northern Iowa where he has taught biology and teacher preparation classes for the past 35 years. His area of expertise is in prairie restoration/reconstruction and management. He received his bachelor's degree from the University of Iowa, his masters from the University of South Dakota and his Ph.D. from the University of Iowa. He is frequently called up on as a consultant in prairie reconstruction projects. He has been a consultant for plant

community analysis for the Iowa Department of Transportation and the Iowa Department of Natural Resources, and he developed the original restoration/reconstruction master plan for the Neal Smith National Wildlife Refuge and Prairie Learning Center located near Prairie City, Iowa. He directs the UNI Native Roadside Vegetation center and was Director of the Twelfth North American Prairie Conference. He also teaches Prairie Ecology and Restoration Ecology at the Iowa Lakeside Laboratory, the field station for Iowa's three state universities. Smith was a primary participant in the public television program, Land Between Two Rivers.



General Sessions

General Session III

The Science of Human and Animal Vocalization

Ingo R. Titze, Ph.D.

Saturday, April 30th, 11:00a.m.

Kimmel Theatre, Open to the Public

Sound production in humans and animals involves the vibration of biological tissue, resonance of sound with air columns, and radiation of sound from orifices. Non-ideal sizes and location of sound sources present a great challenge for obtaining the desired loudness, frequency, and sound quality. Analysis with nonlinear dynamics shows how species utilize material and structural nonlinearities to produce sounds ranging from song-like (periodic) to shriek-like (chaotic). In teaching, singing, and public speaking, an overdose of self-induced tissue vibration can damage vocal cord tissues, a problem for which tissue engineering and molecular biology has provided some answers.

Only fragments of scientific information about the physics and physiology of vocalization can be gained experimentally. This includes imaging, electromyography of muscle activity, and excised larynx studies with tissues obtained from cadavers. The macro-integration of all these fragmentary data is performed with computer simulation, of which there will be ample demonstration, including singing, speaking, and a tiger roar.



Ingo Titze, PhD, is the Executive Director of the National Center for Voice and Speech. He also is a Distinguished Professor of Speech Science and Voice in the Department of Speech Pathology and Audiology, The University of Iowa, and the School of Music . He is also a member of the Bioengineering faculty at the same institution.

Formally educated as a physicist and engineer, Dr. Titze has applied this knowledge to a lifelong love of vocal music. His research interests include biomechanics of tissues used in phonation, acoustic phonetics, speech science, voice disorders, professional voice production, musical acoustics, animal vocalization, singing synthesis and the computer simulation of voice.

He earned his bachelor's and master's degrees in electrical engineering from the University of Utah and his doctoral degree in physics from Brigham Young University . He has published widely in the area of voice and has authored the well-known text, Principles of Voice Production. He is currently completing a text entitled 'Vocology' and another entitled The 'Myoelastic - Aerodynamic Theory of Phonation ' . With more than 250 journal articles to his credit, Dr. Titze is a guest lecturer throughout the world. His concerts and educational lectures with "Pavarobotti," a singing robot, have been publicized internationally in such publications as USA Today, The Chicago Tribune and major publications in Vienna , New York and Rome . Dr. Titze is the recipient of the William and Harriott Gould Award for laryngeal physiology, the Jacob Javits Neuroscience Investigation Award, the Claude Pepper Award and the Quintana Award. In addition to his scientific endeavors, Dr. Titze continues to sing, giving recitals of classical songs and show tunes.

Symposia Programs

A. Ecology of Overlooked Landscapes

On a national or global scale, the culture, politics and biology of small, less populous states such as Iowa often are overlooked. This symposium will celebrate the interesting ecology that can be found in habitats of our state that also are commonly overlooked. We will briefly examine the autumn migration of raptors through featureless landscapes, the plant ecology of pastures, and the ecology of a threatened turtle species in sand prairies. **Presiding:** Bob Black, Department of Biology, Cornell College, Mount Vernon

Importance of sand prairies to ornate box turtles in Iowa, Neil P. Bernstein* and Rebecca Richstmeier, Department of Biology, Mount Mercy College, Cedar Rapids; Bob Black and Andrew Bausch, Department of Biology, Cornell College, Mount Vernon

Autumn raptor migration through featureless country, Bob Black, Dale Shafer, David Kyllingstad, and Alyssa Borowske, Department of Biology, Cornell College, Mount Vernon

The ecology and natural history of pastureland, Tom Rosburg*, Drake University, Des Moines

B. Past, Present, and Future Investigations on Water-Quality Issues in Iowa

A panel of U.S. Geological Survey and Iowa Geological Survey water-quality research scientists will discuss past, present, and future investigations on water-quality issues in Iowa. Water-quality investigations conducted by the panel include focused studies on the Big Spring Basin, Fourmile Creek, the Cedar River, as well as reconnaissance studies on groundwater and surface water resources throughout the State. Following the presentations, the panel will address questions from the audience. **Presiding:** James Caldwell*, District Groundwater Specialist, United States Geological Survey, Iowa City

Pharmaceuticals and other emerging contaminants in US water resources, Dana Kolpin, Research Hydrologist, United States Geological Survey, Iowa City

Time of travel, Lagrangian sampling, and water-quality: studies from Fourmile Creek and the Cedar River, Iowa, Douglas J. Schnoebelen, Research Hydrologist/Water Quality Specialist
United States Geological Survey, Iowa City

The Big Spring Basin at Twenty, Robert Libra, State Geologist, Iowa Geological Survey, Iowa City

A Presentation by Mark Skopec, Mark Skopec, Section Supervisor, Water Monitoring, Iowa Geological Survey, Iowa City

C. Geologic Contributions to Archaeological Method and Theory

With the recognition that prehistoric cultural remains are fundamentally part of the stratigraphic record, geology has played an ever-increasing role in the formulation of interpretations of the archaeological record. From designing and conducting effective and efficient searches for cultural deposits, to geochemical analyses of material remains, to paleoenvironmental analyses, archaeologists are integrating earth science concepts, methods and techniques into their methods and theories. This session highlights a range of examples of these geologic contributions. **Presiding:** Rhawn Denniston*, Department of Geology, Cornell College, Mount Vernon, Iowa
Presentations

Defining a Paleoindian District on the Eastern Plains - Ozark Boundary in Southwest Missouri, Edwin R. Hajic, Quaternary Studies Center, Illinois State Museum

Stable Isotope Geochemistry: An Important Tool In The Kit For Archaeological and Paleoanthropological Research, Art Bettis, Department of Geosciences, University of Iowa, Iowa City

Black dirt and gray literature: Creating a Holocene stratigraphy database from geoarchaeological reports, Melanie Riley and Joe Artz, Office of the State Archaeologist, Iowa City

Better Archaeology from better geology; Current status and future directions of the UI-OSA lithic raw material assemblage, Mark Anderson*, Office of the State Archaeologist, Iowa City, Iowa

A petrographic study of Shoshonean pottery from the eastern Snake River Plain, Idaho, Paul Garvin*, Department of Geology, Cornell College, Mount Vernon

* = Iowa Academy of Science Member

GENERAL POSTER SESSION
FRIDAY, APRIL 29TH, 5:00-6:00PM

Botany

5. *HELIANTHUS* USED BY *STRAUZIA*: THREE SPECIES OR FIVE?, Heather Axen
6. TRANSCRIPT QUANTITATION OF ZEA MAIZE PPK MRNA, Sara Getty
7. IS THE PLANT ENZYME PPK NECESSARY FOR THE PLANT TO LIVE? AN EVALUATION OF PPK GENE KNOCKOUT MUTANTS OF THE SMALL MUSTARD PLANT, *ARABIDOPSIS THALIANA*, Eun Hyuk Chang
8. MYCORRHIZAS IN TWO SPECIES OF VITACEAE [GRAPE FAMILY], Forest I. Isbell

Cellular, Molecular & Microbiology

22. IDENTIFICATION OF NEURONAL PROTEIN BINDING TARGETS OF THE PSEUDORABIES VIRUS GE PROTEIN, A.M. Holbrook
30. HETEROCHROMATIN BOUNDARY ELEMENTS AND CHROMOSOME FRAGILE SITES IN THE YEAST *SACCHAROMYCES CEREVISIAE*, K.J. Ross

College Science Teaching

47. COMMON MISCONCEPTION ON NEWTON FIRST LAW, Behiye Akcay (Bezir)
48. A CASE STUDY OF EXPERIENCES IN INFORMAL SCIENCE SETTINGS AS A SCAFFOLD OF FORMALSCIENCEEDUCATION, Pi-Chu Kuo

Conservation

56. UTILIZATION OF GOLF COURSES AND OTHER URBAN GREEN SPACES AS AMPHIBIAN REFUGIA, Ann Calhoun
57. EARLY TREE GROWTH PATTERNS IN A CONIFER RESTORATION, Leigh A. Cooper
58. THE EFFECTS OF BURNING AND MOWING ON DETRITUS AND SOIL FAUNA OF A TALLGRASS PRAIRIE, C. Mitros
59. AN EXPERIMENTAL TEST OF NICHE THEORY WITH REALISTIC EXTINCTION SCENARIOS, David Losure
60. THE MACROINVERTEBRATE COMMUNITY IN A NEWLY CONSTRUCTED WETLAND RECEIVING URBAN RUNOFF: AN EVALUATION OF FACTORS CAUSING SPATIAL VARIATION IN BIOMASS, DENSITIES, AND DIVERSITY, Daniel R. Rosauer
61. SURVEYING PRAIRIES FOR SMALL MAMMALS IN AND AROUND RICE COUNTY, MN., Jared Walker Smith
62. MOVEMENT BEHAVIOR OF GRASSLAND BUTTERFLIES IN MIXED HABITATS OF CENTRAL IOWA, Ashley A. Wick

Environmental Science & Health

89. RELATIONSHIPS BETWEEN FISH COMMUNITY AND STRUCTURAL INDICES IN ASSESSING POPULATION BALANCE WITH A PROPOSAL FOR REGIONAL MODIFICATION OF STOCK DENSITY INDICES, Nicholas L. Ahrens
90. USE OF FALLEN TREES FOR SPAWNING BY THE SPOTFIN SHINER (*CYPRINELLA SPILOPTERA*) IN THE UPPER MISSISSIPPI RIVER, Jennifer Cochran
91. THE COMBINED EFFECTS OF ATRAZINE AND METOLACHLOR ON SURVIVAL RATE, MALE TO FEMALE SEX RATIO AND GROWTH RATES IN *POECILIA RETICULATE*, C. Reiling
92. A SURVEY FOR CHOLESTEROL REDUCTASE ACTIVITY IN PLANTS GROWN IN IOWA, B.W. Steussy

Geology

97. ANALYSIS OF NUTRIENT SOURCES, ACCUMULATION, AND TRANSPORT AT WEST LAKE IN CEDAR FALLS, IOWA, N.L. Carmichael

GENERAL POSTER SESSION
FRIDAY, APRIL 29TH, 5:00-6:00PM

Physics

112. STELLAR PHOTOMETRY FROM A DEEP ATMOSPHERE SITE, J.A. Wilkerson

Physiology

113. ASSESSMENT OF BAROREFLEX AND CHEMOREFLEX CONTROL OF BLOOD PRESSURE BY CAROTID ARTERY OCCLUSION IN MICE, F. Carneiro
114. VASCULAR SYMPATHETIC RESPONSIVENESS MODULATES LOW FREQUENCY BLOOD PRESSURE VARIABILITY (MAYER WAVES), Stauss H. M.
115. ISOKINETIC EVALUATION OF THE ANKLE PLANTAR FLEXION AND DORSIFLEXION GENERATED FORCE BEFORE AND AFTER CREATINE SUPPLEMENTATION, Jessica L. Griggs
116. POTASSIUM CHANNEL DEFECTS CONTRIBUTE TO DECREASED EXCITABILITY OF NODOSE NEURONS IN SPONTANEOUSLY HYPERTENSIVE RATS, Krishna Iyer
117. NOVEL MOLECULAR DEFECTS IN MECHANOSENSITIVITY OF AORTIC BARORECEPTOR NEURONS FROM SPONTANEOUSLY HYPERTENSIVE RATS, Krishna Iyer
118. ABNORMAL HEART RATE AND BLOOD PRESSURE CIRCADIAN RHYTHMS IN HYPERTENSIVE AND HYPERCHOLESTEROLEMIC MICE, N. Maheshwari
119. THE EFFECTS OF AVR-15(AD1051) MUTATION ON LONG TERM MEMORY IN CAENORHABDITIS ELEGANS, C. B. Peters
120. MYOGENIC VASCULAR FUNCTION ASSESSED BY BLOOD PRESSURE VARIABILITY IS IMPAIRED IN SPONTANEOUSLY HYPERTENSIVE RATS, Harald M. Stauss
121. SUBUNITS OF ACID-SENSING ION CHANNELS (ASICs) DIFFERENTIALLY MEDIATE BARORECEPTOR AND CHEMORECEPTOR REFLEXES, R. Sabharwal
122. CHARACTERIZATION OF A NOVEL MICE MODEL OF HYPERTENSION AND HYPERCHOLESTEROLEMIA WITH REDUCED LIFE SPAN, M. Yerke
123. EXPLORING LAMOTRIGINE'S POTENTIAL USE AS A NEUROPROTECTIVE AGENT, N.M. Wilson,
124. PHYSIOLOGICAL EFFECTS OF GINKGO BILOBA, J. N. Wolff

Zoology

126. EFFECTS OF PREDATORIAL THREATS ON THE PARENTAL BEHAVIOR OF HOUSE WRENS (*TROGLODYTES AEDON*), Alyssa M. Anderson
127. SEA URCHIN EMBRYOS: MORPHOMETRIC ANALYSIS OF SEPARATED BLASTOMERE-DERIVED EMBRYOS, J. W. Brittingham
128. PRESERVATION OF THE PUTNAM MUSEUM ORNITHOLOGY COLLECTION, Chandler, Christine L.
129. SEXUAL DIMORPHISM IN LIFE HISTORY TRAITS OF A MIGRATORY DRAGONFLY, THE COMMON GREEN DARNER, Paul Decker
130. A TEST FOR OLFACTORY RECOGNITION OF PARENTAL ADULTS BY FREE-SWIMMING YOUNG OF BIPARENTAL CICHLID FISH, Tom Dye
131. STRAUZIA LONGIPENNIS: ONE SPECIES OR FIVE?, Jessica Harrison
132. THE ROLE OF OXIDATIVE STRESS IN MATERNAL MTDNA INHERITANCE, Frank Johnson
133. SITES OF COURTSHIP IN TROPICAL FRUIT FLIES (BLEPHARONEURA: TEPHRITIDAE), J. Johnson
134. WING SHAPE IN BLEPHARONEURA (DIPTERA: TEPHRITIDAE): A MORPHOMETRIC APPROACH, Sara Marsteller
135. THE EFFECT OF UV-B RADIATION ON THE PROLIFERATION OF EPIDERMAL CLUB CELLS IN ZEBRAFISH, Courtney Rud
136. NEW SPECIES OF TROPICAL FRUIT FLIES: EVIDENCE FROM BEHAVIOR AND MOLECULES, F. Serna
137. PROTEIN PHOSPHORYLATION AND THE ASSEMBLY OF SEA URCHIN EGG MICROTUBULES, Samadhi Wijesinghe
138. ABIOTIC DIFFERENCES IN NEST SUBSTRATE THAT MAY DETERMINE PREPRODUCTIVE SUCCESS AND PATTERNS OF CARE IN FATHEAD MINNOW (*PIMEPHALES PROMELAS*), Katie Geray

SPECIAL POSTER SESSION
CELLULAR, MOLECULAR, AND MICROBIOLOGY
SATURDAY, APRIL 30TH, 10:00-11:00AM

11. INDUCTION OF CANDIDA DRUG RESISTANCE GENE (CDR1) BY STEROIDS AND SELECTIVE ESTROGEN RESPONSE MODULATORS (SERMS), Andrea Brockman
12. CARBOXYL TERMINAL NHE-1 EPI TOPE TAGGED CONSTRUCTS, Derick S Burgad
13. TESTING MUTATION RATES OF ANTI-PERSPIRANT DEODORANTS WITH THE AMES *SALMONELLA* ASSAY, Amanda Daigle
14. CHROMOSOME TRANSGENICS IN OAT-MAIZE ADDITION LINES: A CYTOLOGICAL ANALYSIS OF C4 PHOTOSYNTHETIC LEAF STRUCTURE, Keri Drake
15. ERK ACTIVATION MEDIATED BY SHORT CHAIN PHOSPHOTIDIC ACID, Matthew Duval
16. ISOLATION OF GENES RESPONSIBLE FOR PHENOTYPIC PLASTICITY IN THE GRAY TREE FROG *HYLA VERSICOLOR*, Lisa Fettkether
17. THE CLONING, SEQUENCING, AND CHARACTERIZATION OF CDNA(S) FROM *PECTINARIA GOULDII*, H. Friberg
18. EFFECTS OF RAP1 ON THE SMALL G PROTEINS RAC1 AND CDC42: A POSSIBLE ROLE FOR RAP1 IN CELL CYCLE CONTROL, Amy Gaviglio
19. ALLOPARENTAL CARE AND FILIAL CANNIBALISM IN A WILD POPULATION OF FATHEAD MINNOWS (*PIMEPHALES PROMELAS*), Katie R. Geray
20. CHROMOSOME TRANSGENICS IN OAT-MAIZE ADDITION LINES: IMMUNOCYTOLOGICAL ANALYSIS OF THE C4 PHOTOSYNTHETIC ENZYME PEPC, Rachel Hansen
21. THE ERYTHROPOIETIN RECEPTOR ACTIVATES BOTH PRO- AND ANTI-APOPTOTIC SIGNALING PATHWAYS IN THE PRESENCE OF ULTRAVIOLET RADIATION, M. K. Henry
23. PRODUCTS THAT BLOCK ADHERENCE OF CANDIDA TO VAGINAL EPITHELIAL CELLS (VEC), Cara Hollmer
24. IDENTIFICATION OF YEAST GENES IMPORTANT FOR CHROMOSOME TRANSMISSION, Stephanie Leeson
25. CREATION OF A GENETIC ASSAY FOR STUDYING CHROMOSOME BREAKAGE IN THE YEAST *SACCHAROMYCES CEREVISIAE*, J.J. Lurz
26. THE ROLE OF THE CELL CYCLE CONTROL GENE CDC28 ON MITOCHONDRIAL INHERITANCE, Kyle Marthaler
27. CHARACTERIZATION OF THE *FOOL'S GOLD* ZEBRAFISH MUTANT, L. Miller
28. ASSESSING GENETIC DIVERSITY OF *PIMEPHALES PROMELAS* IN BUDD LAKE USING PCR-BASED MICROSATELLITE ANALYSIS, Diane Nelson
29. IS MITOCHONDRIAL INHERITANCE TISSUE SPECIFIC? A NEW LOOK AT THE MTDNA DOGMA FROM A CELL BIOLOGY PERSPECTIVE, Jennifer Risan
31. EFFECT OF CELL CYCLE INHIBITORS ON MITOCHONDRIAL REPLICATION, Marina Shakya
32. MATRIX METALLOPROTEINASE 9 ACTIVATION THROUGH THE SODIUM HYDROGEN EXCHANGER, Taves J.M.
33. A NOVEL APPROACH OF ASSESSING EFFECTS OF CELL CYCLE REGULATORY PROTEINS MAD 2/MAD3 DEGRADATION ON MITOCHONDRIAL DYNAMICS USING A TEMPERATURE SENSITIVE PLASMID CONSTRUCT TS-DEGRON, Dyan Voge

2005 IAS ANNUAL MEETING – SECTION MEETINGS

AGRICULTURAL SCIENCES (Room 124, Armstrong)

- 10:00 1. PLANTS REGENERATED FROM EMBRYO CULTURES OF AN APOMICTIC CLONE OF KENTUCKY BLUEGRASS (*POA PRATENSIS* L. 'BARON') ARE NOT APOMICTIC IN ORIGIN, L. C. Stephens
- 10:15 2. THE ROOT DRY WEIGHT / TRANSPIRATION RATE RATIO AS A PREDICTOR OF THE EFFECT OF DAILY IRRIGATION WITH FRESH WATER ON THE BORON TOLERANCE OF CROPS, Kristine L. Robson
- 10:30 **Section Business Meeting**

ANTHROPOLOGY (Berlin Room in Commons)

- 8:30 3. ORGANIZATIONAL CULTURE AT THE SLATE VALLEY MUSEUM, Jason Arends
- 8:50 4. THE LITHIC ANALYSIS OF FLAKING DEBRIS FOR LATE WOODLAND NATIVE AMERICAN ARCHAEOLOGICAL SITES IN THE PALISADES-DOWS NATURE PRESERVE, LINN COUNTY, IOWA, Andrew C. Sorensen
- 9:10 **Section Business Meeting**

BOTANY (Room 124, Armstrong)

- 8:15 9. HISTORIC VEGETATION PATTERNS AND DYNAMICS OF THE NORTHERN LOESS HILLS, Jim Stroh
- 8:30 10. ASPECTS OF THE DIATOM FLORA OF BEAR MEADOWS BOG, CENTRE COUNTY, PENNSYLVANIA, L.A. Brant
- 9:00 **Section Business Meeting**

CELLULAR, MOLECULAR & MICROBIOLOGY (Hedges in Commons)

- 8:30 34. STRUCTURAL DETERMINANTS OF VIRULENCE IN COXSACKIEVIRUS B3 RNA, Johanna M. Missak
- 8:45 35. TESTING ORGANIC VERSUS NON-ORGANIC GROWN FOODSTUFFS FOR MUTAGENICITY WITH THE AMES TEST, Beth McQuinn
- 9:00 36. *ESCHERICHIA COLI* BECOMES LESS SENSITIVE TO TRICLOSAN AFTER REPEATED EXPOSURE, Veronica Cantu
- 9:15 37. A NOVEL APPROACH OF ASSESSING EFFECTS OF CELL CYCLE REGULATORY PROTEINS MAD 2/MAD3 DEGRADATION ON MITOCHONDRIAL DYNAMICS USING A TEMPERATURE SENSITIVE PLASMID CONSTRUCT TS-DEGRON, Ava-Gaye Simms
- 9:30 38. PHYSIOLOGICAL AND TRANSCRIPTIONAL RESPONSE OF *SACCHAROMYCES CEREVISIAE* TO LOSS OF CELL WALL CHITIN, M.E. Strenk
- 9:45 Break
- 10:00 **Cellular, Molecular, and Microbiology Special Poster Session, 1st Floor Commons**
- 12:45 39. A BIOCHEMICAL ANALYSIS OF SMALL G PROTEIN SIGNALING IN AUTISM, Jill M. Skolte
- 1:00 40. HYDROXYCINNAMALDAHYDE INDUCES A G1 AND G2/M CELL CYCLE ARREST AND DECREASES HEMATOPOIETIC CELL SURVIVAL, D. Cox
- 1:15 41. TEA EXTRACTS INHIBIT GROWTH AND FUNCTIONS OF LEUKEMIC LYMPHOCYTES AND MONOCYTES BUT NOT NORMAL HUMAN BLOOD CELLS, L. A. Beltz
- 1:30 42. ERK ACTIVATION AND WOUND HEALING THROUGH PHOSPHOLIPASE D IN AN A1-ADRENERGIC PATHWAY, R.L. Sang

CELLULAR, MOLECULAR & MICROBIOLOGY CONTINUED (Hedges in Commons)

1:45 **Section Business Meeting**

2:00 43. CHROMOSOME TRANSGENICS IN OAT-MAIZE ADDITION LINES: IMMUNOCYTOLOGICAL ANALYSIS OF THE C4 PHOTOSYNTHETIC ENZYME PPK, Megan Multhaupt

2:15 44. DETERMINATION OF C4 ENZYME ACTIVITIES IN OAT-MAIZE ADDITION LINES BY ENZYME ASSAYS, Derek Nelson

2:30 45. ISOLATION AND SEQUENCING OF PATHOGEN RESISTANCE GENE ANALOGS IN NATIVE IOWA PRAIRIE PLANTS, K. M. Connolly

2:45 46. ISOLATION OF A PORTION OF THE ACETYL COENZYME A CARBOXYLASE GENE FROM SCHIZACHYRIUM SCOPARIUM, N.E. Patterson

CHEMISTRY: INORGANIC, PHYSICAL, & ANALYTICAL (Paris Room in Commons)

9:00 **Section Business Meeting**

CHEMISTRY: ORGANIC AND BIOLOGICAL (Paris Room in Commons)

9:20 **Section Business Meeting**

COLLEGE SCIENCE TEACHING & SCIENCE TEACHING (Room 24, Armstrong)

8:30 49. A VIRTUAL LABORATORY AS PREPARATION FOR HANDS-ON LABORATORY, J. L. Bonte

8:45 50. IS THE EARTH FLAT? A WAY TO DEMONSTRATE SCIENTIFIC PROCESS, T. C. Gibbons

9:00 **Section Business Meeting**

9:15 Break

9:30 51. DISCOVERING THE SPECIAL PROPERTIES OF BEZI'ER CURVES, Leon Tabak

9:45 52. WHAT ARE THE IMPACTS OF INQUIRY-BASED TEACHER EDUCATION PROGRAM ON THE BELIEFS OF PRESERVICE SCIENCE TEACHERS IN SCIENCE EDUCATION?, Hakan Akcay

10:00 53. SCIENCE TECHNOLOGY AND SOCIETY PROGRAMS MAKE DIFFERENCE!, Hakan Akcay

10:15 54. A HARD LOOK AT IOWA SCIENCE EDUCATION: HOW MUCH DEEPER SHOULD WE DIG?, Ken E. Lassila

COMMUNITY COLLEGE BIOLOGISTS (Room 124, Armstrong)

9:15 55. THE BUTTERFLIES OF BELIZE, C.W. Schutte

9:30 **Section Business Meeting**

CONSERVATION (Room 224, Armstrong)

- 8:30 63. EVALUATION OF MACROINVERTEBRATE ASSEMBLAGE STRUCTURE IN A SOUTHWEST IOWA STREAM WITH GRADE CONTROL STRUCTURES, Mary E. Litvan
- 8:45 64. THE FRESHWATER GASTROPODS OF IOWA (1821-1998): SPECIES COMPOSITION, GEOGRAPHIC DISTRIBUTIONS, AND CONSERVATION CONCERNS, Timothy W. Stewart
- 9:00 65. GENETIC VARIATION OVER TWO GENERATIONS OF THE NATIVE PRAIRIE PLANTS: *PANCIUM VIRGATUM* AND *COREOPSIS PALMATE*, F. M. Kruse
- 9:15 66. IOWA FENS IN THE WETLANDS RESERVE PROGRAM, Jennifer S. Anderson-Cruz
- 9:30 67. A MODEL OF GRASSLAND BUTTERFLY MOVEMENT IN KUEHN CONSERVATION AREA, DALLAS COUNTY, IA, David Courard-Hauri
- 9:45 68. BUTTERFLY DIVERSITY IN A FRAGMENTED LANDSCAPE: THE ROLE OF RAILROAD RIGHTS-OF-WAY, Jessica D. Davis Skibbe
- 10:00 69. Distribution, Abundance, and Diversity of Solitary Bees in Fragmented Tallgrass Prairie Landscapes, Chiara J. Hemsley
- 10:15 70. TEMPORAL AND SPATIAL VARIATION OF FLORAL RESOURCES FOR PRAIRIE POLLINATORS IN FRAGMENTED LANDSCAPES, Amber F. Hill
- 10:30 71. UTILIZATION OF GOLF COURSES AS REFUGIA FOR NATIVE VERTEBRATES, David A. McCullough
- 10:45 **Section Business Meeting**

ENGINEERING (Shaw in Commons)

Medical Applications

- 8:30 72. PERISTALTIC TRANSPORT AND MIXING OF PARTICLES IN THE GI TRACT, S. Krishnan
- 8:45 73. FACTORS INFLUENCING MENTAL ROTATION PERFORMANCE, Shan Bao
- 9:00 74. DEVELOPMENT OF RESEARCH PLATFORMS FOR COCHLEAR IMPLANT STUDIES, Ketki Shah
- 9:15 75. SYSTEM TO EXTEND THE HEARING CAPABILITIES OF COCHLEAR IMPLANT PATIENTS, Kyle Thureen
- 9:30 Break

Industrial Engineering

- 9:45 76. ASSESSING THE RELATIVE RISK OF SEVERE INJURY IN AUTOMOTIVE CRASHES FOR OLDER FEMALE OCCUPANTS, John Hill
- 10:00 77. DRIVER ACCEPTANCE OF DISTRACTION MITIGATION STRATEGIES: FOCUS GROUP AND SIMULATOR STUDIES, Birsen Donmez
- 10:15 78. DRIVER DISTRACTION AND RELIANCE: ADAPTIVE CRUISE CONTROL IN THE CONTEXT OF SENSOR RELIABILITY AND ALGORITHM LIMITS, Bobbie Seppelt
- 10:30 79. CONDITION BASED REPLACEMENT MODELS, Elwany, A. H.
- 10:45 Break

Mechanical Modeling

- 1:00 80. MECHANICS OF CARBON NANOTUBES AND THEIR REINFORCED ALUMINUM-BASED COMPOSITES, W. Hou
- 1:15 81. MULTISCALE MODELING OF PARTICLE-SOLIDIFICATION FRONT DYNAMICS, J.W. Garvin
- 1:30 82. DENDRITE-PARTICLE INTERACTION NUMERICAL SIMULATION, Y. Yang
- 1:45 83. A NANOSCALE MESHFREE PARTICLE METHOD, W. Yang

ENGINEERING CONTINUED (Shaw in Commons)

2:00 84. MODELING EFFECT OF SURFACE HETEROGENEITY ON THIN FILMS USING A DISJOINING-PRESSURE PRECURSOR-FILM APPROACH, Y. Zhao

2:15 **Section Business Meeting**

2:30 Break

Hydraulics and Environmental Science

2:45 85. UNLOCKING THE SCIENTIFIC VALUE OF NEXRAD WEATHER RADAR DATA, R. Lawrence

3:00 Break

3:15 86. FATE OF ANTIBIOTICS AND PHARMACEUTICALS IN WASTEWATER TREATMENT PLANTS, Brett Woods

3:30 87. INTERACTION OF A PUMP IMPELLER AND AN INTAKE VORTEX, X. Liu

3:45 88. PREDICTION OF MAXIMUM SPREAD RATIO FOR DROPLET IMPACT ON A SOLID, SMOOTH SURFACE, Brett Bathel

ENVIRONMENTAL SCIENCE & HEALTH (Berlin Room in Commons)

9:30 93. PHOSPHORUS SEQUESTRATION IN WETLAND SEDIMENTS, Ann Schwemm

9:50 94. DETERMINING THE SOURCE OF FECAL CONTAMINATION IN RECREATIONAL WATERS, Christin M. Appletoft

10:10 95. EFFECTS OF ENVIRONMENTAL ESTROGENS ON THE DEVELOPMENT OF THE SOUTH AFRICAN CLAWED FROG *XENOPUS LAEVIS*, S. Sandford

10:30 96. THE EFFECT OF PESTICIDES ON HUMAN CELL GROWTH, K.R. Dhanwada

10:40 **Section Business Meeting**

GEOLOGY (Martin Luther Room in Commons)

8:15 98. SILICIFICATION OF CORALS, STROMATOPORIDS AND BRACHIOPODS AT THE WEATHERED SURFACE WITHIN THE DEVONIANAGE LITTLE CEDAR FORMATION (SOLON AND RAPID MEMBERS) OF EASTERN IOWA, Adam L. Majeski

8:30 99. STATEMAP BEDROCK GEOLOGIC MAP OF SOUTHEAST IOWA; THE FINAL PIECE OF THE NEW DIGITAL GEOLOGIC MAP OF IOWA, R.R. Anderson

8:45 100. THE LITHOSTRATIGRAPHY AND DEPOSITIONAL ENVIRONMENTS OF THE PELLA FORMATION (MISSISSIPPIAN) IN KEOKUK AND WAPELLO COUNTIES, SOUTHEASTERN IOWA, Beason, Scott R.

9:00 101. THE SEARCH FOR A LOWER MOSCOVIAN (PENNSYLVANIAN) BOUNDARY STRATOTYPE (BIOSTRATIGRAPHIC AND CHEMOSTRATIGRAPHIC CONSIDERATIONS), Groves, John R.

9:15 102. URANIUM-LEAD DATING OF A CORAL FROM THE NEOGENE GURABO FORMATION, DOMINICAN REPUBLIC, P. Cole

9:30 103. STABLE ISOTOPIC TRENDS IN 23-16 ka ARKANSAS STALAGMITE, B. Hoye

9:45 104. EXPLORING THE ROLE OF THE HYDROLOGIC CYCLE IN CLIMATE MODEL SIMULATIONS OF PAST GREENHOUSE WORLDS, G.A. Ludvigson

10:00 105. RESPONSE OF PLEISTOCENE EPIBIONT COMMUNITIES TO TERRIGENOUS SEDIMENTATION ON THE WESTERN AUSTRALIAN COAST, Meredith M. Clayton

10:15 106. TEMPORAL AND SPATIAL VARIATION IN MOBILE SOIL ARSENIC AND THE SELF-ORGANIZATION OF ECOSYSTEMS, Aimee J. Luhrs

10:30 **Section Business Meeting**

GEOLOGY CONTINUED (Martin Luther Room in Commons)

- 10:45 Break
- 1:00 107. THE PALEOECOLOGY OF AN ENCRUSTED DEVONIAN BRACHIOPOD ASSEMBLAGE: CEDAR VALLEY FORMATION, IOWA, A.E. Webb
- 1:15 108. AN HISTORICAL APPROACH TO THE ORIGIN OF CATSTEPS IN THE LOESS HILLS OF WESTERN IOWA, Kimberly R. Dillon
- 1:30 109. A STABLE ISOTOPIC ANALYSIS OF AN END PLEISTOCENE-AGE STALAGMITE FROM WEST-CENTRAL PORTUGAL, A. C. Borowske
- 1:45 110. DEVELOPMENT OF A USER-FRIENDLY EARTHQUAKE RISK ASSESSMENT PROGRAM FOR BUILDINGS IN SAN FRANCISCO COUNTY, CALIFORNIA, Brian J. Craig
- 2:00 111. TRACE ELEMENT AND ISOTOPE SYSTEMATICS OF PHONOLITE AND OTHER ROCKS OF THE CHICO SILL COMPLEX, NE NEW MEXICO, L. S. Potter

PHYSICS (Paris Room in Commons)

- 9:40 **Section Business Meeting**

PHYSIOLOGY (Paris Room in Commons & Room 144, Armstrong)

- 10:20 **Section Business Meeting** (Paris Room in Commons)
- 10:45 125. ASSAYS OF HER-2/NEU, ESTROGEN AND PROGESTERONE RECEPTORS, AND FISH RATIOS IN INVASIVE BREAST CARCINOMAS: ACCURACY OF PATHOLOGICAL ANALYSIS IN DETERMINING TREATMENT, Emily Knoble (Room 144, Armstrong)

PSYCHOLOGY & LINGUISTICS (Paris Room in Commons)

- 10:00 **Section Business Meeting**

ZOOLOGY (Room 144, Armstrong)

- 8:30 139. ONLINE HERPETOLOGICAL ATLAS OF IOWA, Jeffrey R. Parmelee
- 8:45 140. POPULATION DECLINES IN ILLINOIS MUD TURTLES, James L. Christiansen
- 9:00 141. CONSERVATION GENETICS OF BLUE-SPOTTED SALAMANDERS (*AMBYSTOMA LATERALE*), Jonathan M. Eastman
- 9:15 142. PHYLOGEOGRAPHY OF THE BLUE-SPOTTED SALAMANDER (*AMBYSTOMA LATERALE*), James Demastes
- 9:30 143. BEHAVIOR OF A BIZARRE SALAMANDER, THE LESSER SIREN (*SIREN INTERMEDIA*), Allison A. Cherry
- 9:45 **Section Business Meeting**
- 10:00 144. MORPHOLOGY AND DISCOVERY OF NEW SPECIES: BIOLOGICAL AND PHILOSOPHICAL ISSUES, Matt Nolte
- 10:15 145. MORPHOMETRIC ANALYSIS OF *LYTECINUS VARIEGATUS*, SEA URCHIN EMBRYOS, Tasha R. Beenken
- 10:30 146. CRAB COMMENSALS IN TUBES OF THE POLYCHAETE WORM *CHAETOPTERUS SP.*, THE BRACHYURAN *PINNIXA CHAETOPTERANA* AND THE ANOMURAN *POLYONYX GIBBESI*, Floyd Sandford

Iowa Academy of Science 2005 Awards

2005 Distinguished Awards

The Iowa Academy of Science Distinguished Awards Program recognizes the best contributions of Iowans to science research, science education, and service to science. The **Distinguished Service Award** is presented to an individual, group, or organization for exceptional service in the areas of science, technology, or the application of science to public service. The **Distinguished Fellow Award** is the highest honor the Academy can bestow upon an individual, and is intended to recognize exceptional scholarly activity and/or exceptional service to the scientific community at the national and international levels. Distinguished Fellows receive life membership in the Academy.

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

Distinguished Service

Dr. Lynn Brant, University of Northern Iowa

Distinguished Fellow

Dr. Harry Horner, Iowa State University

2005 Excellence in Science Teaching Awards (ESTA)

The following teachers will be honored at the Awards Luncheon:

Elementary Science

Travis Benner
Bluegrass Elementary School, Davenport

Middle/Junior High Science

Amanda Schiller
Marquette Middle School, West Point

Life Science

Alicia Schiller
Central Lee High School, Donnellson

The Iowa Academy of Science awarded the first Excellence in Science Teaching Awards in 1954. Outstanding teachers of all grade levels and areas of science have been recognized for their work and innovations in science education. Nominations are encouraged from administrators, colleagues, or a teacher may self-nominate. Selections are made by a committee of IAS members. Awardees receive a plaque and a \$200 award.

New Iowa Academy of Science Fellows

The following individuals will be inducted as new IAS Fellows during the IAS Business Meeting:

Dorothy Baringer
Lee Burras
Cliff Chancey

William Desmaris
Charles Drewes
Erica Larson

Sherman Lundy
Aaron Spurr
Rick Wells

Iowa Junior Academy Honors

The Academy is proud to recognize Iowa's Delegates to the 2005 American Association for the Advancement of Science/American Junior Academy of Science Conference:

Amy Marquart of Mediapolis High School
Michael Fosdick of Mediapolis High School
Jamilee Lightfoot of Central Lee High School

Amy, Michael, and Jamilee were selected as delegates from all of the 9th-11th grade IJAS students competing at the 2004 Iowa Academy of Science Annual Meeting. The IAS and ISTS Scholarship Winners, Most Promising Young Scientist and 2006 AAAS Delegate selections will be announced at the Awards Luncheon.

2005 GSI Spring Field Trip
SILURIAN AND QUATERNARY GEOLOGY AT THE MARTIN MARIETTA
CEDAR RAPIDS QUARRY, LINN COUNTY, IOWA
April 30, 2005

prepared and led by the

Geology Faculty
Department of Geology
Cornell College

E. Art Bettis
Department of
Geoscience
University of Iowa

and

Staff Geologists
Groundwater and Stratigraphic Studies Section
Iowa Geological Survey

The **GSI 2005 Spring Field Trip** will provide participants with an abbreviated look at some of the interesting geologic materials southeast of Cedar Rapids. In a return to GSI procedures of many years ago, the Spring Field Trip will be associated with the Iowa Academy of Science, which is meeting at Cornell College in Mount Vernon. This Spring's field trip will begin on **Saturday April 30 at 3:00 pm**, following completion of the Geology Section at the Academy meeting. We will be visiting the **Martin Marietta Cedar Rapids Quarry, 1636 Marietta Road, just south of the Cedar River at the junction of Hwy 30 and 13/151** (Figure 1). Trip participants should meet in the **parking area near the scale house at the Martin Marietta Cedar Rapids Quarry (DO NOT DRIVE ON THE SCALE)**. To get to the quarry, **exit Hwy 30 at the Old River Road (just west of the Cedar River) and proceed south. Immediately south of Hwy 30, turn east on Martin Marietta Road and continue to the scale house parking area.** At the quarry, we will see Silurian dolomites of the Scotch Grove and Gower Formations that are quarried at the site and a very interesting overlying Quaternary section. The Gower Formation is composed of distinctly horizontally-bedded laminated fine-grained dolomites of the Anamosa Member and their laterally equivalent mud and skeletal-rich mounds of the Brady Member. Brady fossils include brachiopods, tabulate corals, solitary corals, gastropods, and nautiloids. Additionally, some spectacular sphalerite (ZnS_2) and pyrite (FeS_2) mineralization has been found in the quarry.

The Quaternary section displays 3 Pre-Illinoian tills resting on very dark gray pro-glacial sediments above a weathered Silurian surface that displays about 3 feet of relief. The tills include abundant well-preserved wood (spruce) fragments that had been buried by the advancing ice sheet 500,000 to 1,600,000 years ago. a sand body near the top of the section was deposited by a river that crossed the area after the glacier retreated. The entire section is overlain by a thick (~50 feet) section of wind-blown Peoria loess, 12-25,000 years old.

Bring your hard hats and safety glasses if you have them. If not, they will be provided. Also, bring your rock hammer and a collecting bag. Rock and fossil collecting will not only be allowed, it will be encouraged.

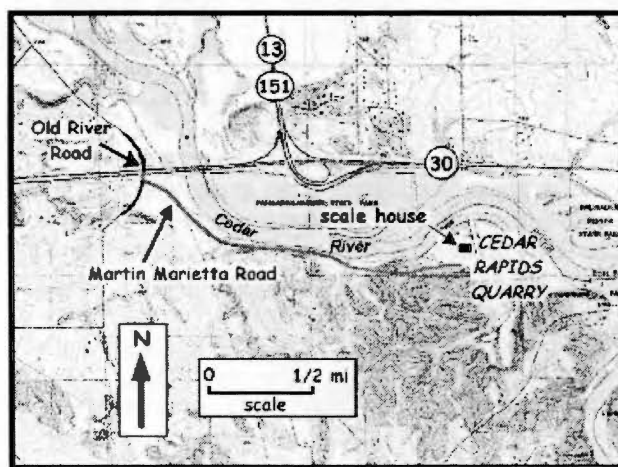


Figure 1. Maps showing meeting location for Spring 2005 GSI field trip, meet near Cedar Rapids Quarry scale house.



Agricultural Sciences

ORAL PRESENTATIONS

1. PLANTS REGENERATED FROM EMBRYO CULTURES OF AN APOMICTIC CLONE OF KENTUCKY BLUEGRASS (*POA PRATENSIS* L. 'BARON') ARE NOT APOMICTIC IN ORIGIN

L. C. Stephens, S.-Z. Fei, Y. Xiong and C. F. Hodges
Department of Horticulture, Iowa State University, Ames

Plants were regenerated from tissue cultures of embryos dissected from seeds that were harvested from a self-pollinated clonal selection of Kentucky bluegrass (*Poa pratensis* L.) 'Baron', an apomictic cultivar. Plants were regenerated from 35 embryo-derived callus cultures of the 3280 embryos that were plated. Flow-cytometric and RAPD-marker analyses were performed to determine if regenerants were or were not apomictic in origin. Fifteen regenerants with the 3c DNA content were classified as arising from $2n + n$ aberrant embryos, which was a higher frequency than expected, based on a chi-square analysis. Of the remaining 20 regenerants with a 2c DNA content, a chi-square test showed that all could have arisen from $n + n$ sexually-derived embryos, based on the observed segregation of $n + n$ regenerants which fit the expected 3:1 ratio of dominant: recessive RAPD-marker phenotypes. The apparent lack of regenerants of apomictic origin, and implications for genetic transformation and breeding of Kentucky bluegrass will be discussed.

2. THE ROOT DRY WEIGHT / TRANSPIRATION RATE RATIO AS A PREDICTOR OF THE EFFECT OF DAILY IRRIGATION WITH FRESH WATER ON THE BORON TOLERANCE OF CROPS

Kristine L. Robson, Steven H. Emerman, Lisa K. Anderson, and Adam Finken
Department of Biology and Environmental Science,
Simpson College, Indianola

The hypothesis of this study was that crops with low root water potential that were grown in boronated soil would show increased growth and reduced mortality when watered daily with fresh water, whereas crops with high root water potential would not. Based on a previous study in which 21 crops were grown in a greenhouse and the root dry weight / transpiration rate ratio was measured as a means of ranking crops in terms of root water potential, 'Red Beard' onion (*Allium cepa* L.) and 'Tom Thumb' lettuce (*Lactuca sativa* L.) were chosen as crops with low root water potential, while 'Elf' sunflower (*Helianthus annuus* L.) and 'Bambino Hybrid' eggplant (*Solanum melongena* L.) were chosen as crops with high root water potential. The above species were grown in a

greenhouse with 24 treatments per species and 10-20 replicates per treatment. In 12 treatments, plants were watered daily with water of concentration 0–165 ppm B (onion, lettuce, eggplant) or 0–66 ppm B (sunflower). In the other 12 treatments, pots were flushed bi-weekly with water with the above concentrations while plants received fresh water daily at the plant transpiration rate. At a given boron concentration, onion and lettuce showed increased growth and reduced mortality when watered daily with fresh water, while sunflower and eggplant did not. Boron levels in plant roots, shoots and leaves will be measured to determine the mechanism by which only crops with low root water potential show increased boron tolerance when watered daily with fresh water.



Anthropology

ORAL PRESENTATIONS

3. ORGANIZATIONAL CULTURE AT THE SLATE VALLEY MUSEUM

Jason Arends
Grinnell College, Grinnell

One of the most important challenges to heritage organizations is to develop an adaptive organizational culture. The Slate Valley Museum, located in Granville, NY, is a heritage site devoted to the history of the slate industry along the New York/Vermont border and the immigrants who came to mine the slate. Fourteen employees, ranging from the director to volunteers, were interviewed about the services the museum provides and the challenges it faces. The employees were then asked to rank the services and challenges by order of importance. The data from these rankings was analyzed using consensus analysis; this provides a measure of the organizational culture for the two major domains of most heritage sites. The Slate Valley Museum employees exhibited a very high degree of agreement about both the goals of the museum and the problems facing it. These results show that the organizational culture of the Slate Valley Museum is well adapted to their business niche.

4. THE LITHIC ANALYSIS OF FLAKING DEBRIS FOR LATE WOODLAND NATIVE AMERICAN ARCHAEOLOGICAL SITES IN THE PALISADES-DOWS NATURE PRESERVE, LINN COUNTY, IOWA

Andrew C. Sorensen
University of Iowa, Office of the State Archaeologist

Archaeological investigations were conducted at three presumed Late Woodland period Native American sites, 13LN315, 13LN316, and 13LN323, located within the Palisades-Dows Nature Area, Linn County, Iowa. This

study was conducted as a field school under the joint auspices of the University Of Iowa's Office of the State Archaeologist (OSA), Iowa City, and Cornell College, Mt. Vernon. Site 13LN315 and 13LN316 are located along a 1930s-vintage Civilian Conservation Corp access road on a gently east-sloping ridge immediately west of the Cedar River. The primary focus of this research was to analyze the chipped lithic materials recovered from each of the three sites. Lithic debitage was cleaned and sorted using standard methodological techniques employed at the OSA. The assemblage was entered into the Statistical Analysis for the Social Sciences (SPSS) software package where descriptive statistics were derived which served as the basis for this analysis. These statistics were useful in drawing inferences about potential prehistoric chipped lithic tool manufacturing behavior, including the possible function of the site (i.e. initial core reduction verses tool finishing, or a combination of the two), the extent of site use (trampling), lithic material preferences, and the use of heat treatment.



Botany

POSTER PRESENTATIONS

5. *HELIANTHUS* USED BY *STRAUZIA*: THREE SPECIES OR FIVE? ^{βββ}

Heather Axen and Jessica Harrison
Cornell College, Mt. Vernon

In studies of host use by insects, reliable identification of hosts is critical. Our goal was to determine if different species of tephritid fruit flies (*Strauzia*) correspond to different species of sunflowers (*Helianthus*) from which the flies were captured. During June and July of 2004 we captured >100 flies from 58 sunflowers. With the help of Dr. Paul Christiansen, we used morphological characters to identify (with some certainty) *H. strumosus* (N=8) and *H. tuberosus* (N=50). We inspected, but did not find flies on other sunflowers (e.g., *H. grosseserratus*, *H. annuus*, *H. hirsutus*); however, the identities of *H. grosseserratus* and *H. hirsutus* as species distinct from *H. tuberosus* is in question. We recognized four morphological variants of *H. tuberosus*, some of which overlapped with *grosseserratus* and *hirsutus*. Morphological characters used to distinguish species of sunflower include: leaf shape, leaf margins, leaf texture, and leaf arrangement. Those characters are highly variable: we found many intermediates, which suggests that plants we found were hybrids (or that the characters are not useful). Possibly, all the sunflowers we observed are members of the same "species" or complex of hybrids. Molecular analyses may be useful to resolve these taxonomic problems in the future.

6. TRANSCRIPT QUANTITATION OF ZEA MAIZE PPDK MRNA ^{βββ}

Brad Burns, Sara Getty, John Skolness and Chris Chastain
Minnesota State University, Moorhead, MN

Plant pyruvate, orthophosphate dikinase (PPDK) is a photosynthetic enzyme in C4 plants. The role of PPDK is largely unknown in C3 plants. Previous scientific literature has proposed that PPDK is involved in biosynthesis. PPDK mRNA will be extracted from Maize (corn), a C4 plant, and Arabidopsis, a C3 plant. C4 plants have high abundance of PPDK, and should also have a high transcript copy number. The mRNA extracted from the Maize will be used as a control. PPDK mRNA will also be extracted from Arabidopsis that have been exposed to varying types of stress. The gene for PPDK has two promoters, and localizes Arabidopsis PPDK in two different areas of the cell. The plastidic promoter produces PPDK with a transit peptide that directs the PPDK to the chloroplasts. Upon entering the chloroplast the transit peptide is removed. The plastidic promoter is located upstream of the cytosolic promoter. The cytosolic promoter for PPDK produces PPDK that is sent to the cytosol. RT PCR, and real time RT PCR will be used to generate a comparison between cytosolic and plastidic C3 PPDK mRNA.

7. IS THE PLANT ENZYME PPDK NECESSARY FOR THE PLANT TO LIVE? AN EVALUATION OF PPDK GENE KNOCKOUT MUTANTS OF THE SMALL MUSTARD PLANT, *ARABIDOPSIS THALIANA*. ^{βββ}

Eun Hyuk Chang, Thomas A. Colquhoun and Chris Chastain
Minnesota State University, Moorhead, MN

The plant enzyme pyruvate, orthophosphate dikinase (PPDK) is poorly understood in terms of its function in plants, although it most likely has a function in some aspect of metabolism. The reason why its role is unknown is that it cannot be researched in plants using conventional research tools. In order to circumvent these limitations, we are using a molecular genetic approach that will allow us to obtain a plant for which the PPDK gene has been inactivated. Studies are underway to identify a plant from a segregating population that lacks PPDK altogether. Failure to find a "PPDK-less" plant from this study will indicate that this enzyme plays a life-giving role to the plant and hence will serve as a starting point to elucidate its exact role in plants.

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<http://www.iacad.org>

8. MYCORRHIZAS IN TWO SPECIES OF VITACEAE [GRAPE FAMILY]

Forest I. Isbell, George E. Erwin and Jean M. Gerrath
Department of Biology, University of Northern Iowa,
Cedar Falls

Mycorrhizas (root-fungal associations) are the most prevalent of the mutualistic interactions between microorganisms and plants. They have been classified according to the structural characteristics of the two symbionts. Arbuscular mycorrhizas are by far the most common type, and are further subdivided as Arum-type or Paris-type, the latter showing extensive hyphal coiling and no intercellular hyphae. Individuals from two species of the Vitaceae (*Vitis riparia*-Wild grape and *Parthenocissus quinquefolia*-Virginia creeper) native to eastern North America were collected from the University of Northern Iowa Preserve in Cedar Falls, Iowa. Roots were cleared, stained with Chlorazol Black E, and prepared for observation with a compound microscope. We found intercellular hyphae, vesicles, and evidence of fungal intrusion into root cells for both species observed. Arbuscules with minimal hyphal coiling and intercellular hyphae were observed in one wild grape individual. We concluded that these two wild species of Vitaceae have vesicular-arbuscular mycorrhizal associations similar to those present in cultivated species. The arbuscules present in the wild grape individual show an Arum-type association, and the Virginia creeper likely has the same. This study is the first to demonstrate the presence of mycorrhizal fungi in wild grown members of the Vitaceae.

ORAL PRESENTATIONS

9. HISTORIC VEGETATION PATTERNS AND DYNAMICS OF THE NORTHERN LOESS HILLS

Jim Stroh and Chad Scherbring
Morningside College, Sioux City

Large tracts of woodland appear to have replaced grasslands and savannas in the Loess Hills in Iowa since European settlement. Our objective was to document vegetation dynamics on four sites in the Loess Hills of Monona, Woodbury, and Plymouth Counties, Iowa. Vegetation change was assessed using black and white aerial photographs (5 dates, 1936-1990) on all sites. Standard dot grids and USGS topographic maps were used to determine areal extent of three different vegetation categories; prairie, woodland and wood-herbaceous transition areas. Belt transects were established to estimate abundance and species composition of woody plants on areas where grassland to woodland change was observed on aerial photos in Woodbury County.

Areal extent of vegetation classified as prairie significantly decreased in all study sites from 1936 to 1990, whereas vegetation areas classified as woodland

significantly increased during the same time period. Woodland succession was up-slope with lower slopes and ravines showing the first presence of woody vegetation. Belt transects indicated the primary woody plant invaders as *Cornus drummondii* and *Amelanchier aborea* in Woodbury County. We speculate that the increase in woody plant abundance on areas designated as prairie has probably been due to suppression of fires and absence of migratory herbivores.

10. ASPECTS OF THE DIATOM FLORA OF BEAR MEADOWS BOG, CENTRE COUNTY, PENNSYLVANIA

L.A.Brant
University of Northern Iowa, Cedar Falls

Lying well south of the glacial margin in Pennsylvania, Bear Meadows is several hundred hectares in area and about 11,000 years old. This site contains acidic water (pH 4.0-4.5) of low conductivity (<40 μ S) and an accumulation of more than two meters of organic sediment. The little-studied diatom flora is dominated by taxa typically found in soft water habitats including the genera *Eunotia*, *Pinnularia*, *Frustulia*, *Neidium*, and *Stenopterobia*. The age and isolation of Bear Meadows would suggest the strong possibility of endemic species, and indeed, there appears to be an undescribed (or very rare) species of *Eunotia*.



Cellular, Molecular & Microbiology

POSTER PRESENTATIONS

11. INDUCTION OF CANDIDA DRUG RESISTANCE GENE (CDR1) BY STEROIDS AND SELECTIVE ESTROGEN RESPONSE MODULATORS (SERMS).^{ISF}

Andrea Brockman, Michael Essmann and Bryan Larsen
Des Moines University, Des Moines

CDR1 is an ATP binding cassette gene that exports chemical substances from the interior of the yeast cells. CDR1's promoter region is responsive to estradiol, but it is unknown how specific this response is to other steroids and SERMS. We have an extensive collection of *Candida albicans* which differ in their growth yield in the presence of nanomolar estradiol 17. We selected 3 estrogen stimulated strains and 3 estrogen inhibited strains of fungi for testing. Reverse transcriptase PCR was used to detect the product of the CDR1 gene following a 2 hour exposure to steroids and SERMS. We found that estradiol increased CDR1 expression 2-10 fold for estrogen sensitive organisms, whereas estrogen intensive organisms had decreased expression of CDR1 in the presence of estradiol. Testosterone increased CDR1 production in all but one organism. Progesterone decreased CDR1 in all but one strain. SERMS tested included Nafoxidine, Tamoxifen and

Clomifene. Nafoxidine decreased CDR1 expression, as did clomiphene and tamoxifen. Because CDR1 may be involved in antifungal drug resistance, it is possible that exposure to certain SERMS may decrease CDR1 expression and may concomitantly increase susceptibility to antifungal treatments.

12. CARBOXYL TERMINAL NHE-1 EPI TOPE TAGGED CONSTRUCTS ^{βββ}

Derick S Burgad, Nicole R King and Joseph Provost
Minnesota State University Moorhead, MN

The NHE family of antiport proteins shuttle H^+ out of the cell in exchange for extracellular Na^+ . The NHE1 isoform regulates intercellular pH as well as acting as a cytoskeletal anchor influencing cell movement. NHE1 activation is controlled by intracellular pH and specific peptide phosphorylation on the carboxy terminal tail. This phosphorylation is mediated through ROCK and $p90^{RSK}$. The control of NHE1 is necessary for cellular motility, regulating intracellular pH, and control of cellular growth.

To better understand the mechanisms by which NHE1 influences cell motility we are creating three chimeric-epitope tagged NHE1 constructs. The first two are NHE1-Enhanced Cyan Fluorescent Protein (ECFP) constructs. ECFP selection was based upon an excitation and emission spectra, which does not overlap BCECF. A pH sensitive dye, BCECF, will be used to test construct transport functionality. These new fusion proteins will allow monitoring of NHE1's intracellular location in real time. Initially ECFP will be fused to the NHE1 carboxyl terminus to determine whether the size and location of the fluorescent tag will inhibit carboxy terminus phosphorylation. A second NHE1 construct will fuse ECFP to the amino terminus. We will also produce a third construct, a carboxy terminus (amino acids 503-815) NHE1-6xHIS fusion protein. The 6xHIS epitope tag is a series of six histidines added to the carboxy end of NHE1. The 6xHIS tag allows protein purification by affinity chromatography. The use of 6xHIS prevents interfering phosphorylation, often seen with glutathione S-transferase (GST) constructs. The NHE1-6xHIS fusion protein will be tested to determine the specific sequence phosphorylated by ROCK.

We hypothesize that ROCK phosphorylates NHE1 at COOH-terminal residues not phosphorylated by $p90^{RSK}$ and that this distinction will manifest itself in differences in the localization of NHE1, regulation of ERM binding, formation of stress fibers, and focal adhesion complexes. Our new constructs will allow future experiments to pinpoint the sites of kinase interaction on NHE1 and identify the results of the phosphorylation in vivo.

13. TESTING MUTATION RATES OF ANTI-PERSPIRANT DEODORANTS WITH THE AMES *SALMONELLA* ASSAY ^{βββ}

Amanda Daigle
Saint Mary's University of Minnesota, Winona, MN

Anti-perspirant deodorants are commonly used substances applied in close proximity to the axillary lymph nodes and breast tissue. The objective of this study was to determine whether anti-perspirant deodorants cause mutations by testing with the Ames *Salmonella* assay. The Ames test is based on the use of *Salmonella typhimurium* bacteria that are mutant for a gene that prevents them from synthesizing histidine. Since cellular growth requires histidine, it must be acquired from the external environment or as a result of a reverse mutation that would allow the bacterium to produce it. The mutant bacteria were added to nutrient agar plates in a top agar containing the test substance and rat liver extract. Positive control plates were made using a known base substitution mutagen, sodium azide, and negative controls were made with distilled water. Any occurrence of colonies indicated a reverse mutation in the gene for histidine. Results of the study showed that mutation rates of Secret and Dove anti-perspirant deodorants were higher, but they were not a statistically significant increase from the negative controls ($p = .06$ and $.15$, respectively). In addition, the active ingredient, aluminum chloride hexahydrate, did not show a statistically significant mutation increase versus the negative controls. The overall mutation rate for the deodorants averaged 4.41×10^{-7} compared to a spontaneous mutation rate (controls) of 2.54×10^{-7} .

14. CHROMOSOME TRANSGENICS IN OAT-MAIZE ADDITION LINES: A CYTOLOGICAL ANALYSIS OF C4 PHOTOSYNTHETIC LEAF STRUCTURE ^{βββ}

Keri Drake
Saint Mary's University of Minnesota, Winona, MN

Oat-maize chromosome addition lines were successfully generated at the University of Minnesota for mapping purposes. Addition lines are oat plants (C3 photosynthesis) that include one or more chromosomes from maize (C4 photosynthesis). Oat-maize addition lines are now available for every maize chromosome, 1 through 10. These oat-maize addition lines may be used to determine the extent to which individual chromosomes contribute to C4 photosynthesis. Investigations have been conducted that focused on chromosome transgenics of C4 leaf morphology. Marked differences in cellular leaf structure exist between C3 and C4 plants. These differences contribute to the greater photosynthetic efficiency observed in C4 plants under adverse conditions. Oat-maize addition plants were compared to normal oat plants for structural differences in leaf morphology—specifically, chloroplast arrangement and the development of Kranz anatomy characteristic of C4 plants. Cryostat microtoming was

used to obtain cross-sections of leaf tissue from plants ranging in the stages of development from seedling to maturity. Bright field and phase contrast microscopy indicated three oat-maize addition lines (chromosomes 3, 7, and 10) that showed an increased level of chlorophyll-laden cells compared to normal oats plants. In particular, the oat-maize chromosome 3 addition line showed cellular leaf anatomy and chloroplast formation with the greatest similarity to maize. Also, the oat-maize chromosome 3 addition line developed large ligules causing the leaves to grow at right angles to the stem of the plant. A gene for ligule formation is known to reside on maize chromosome 3. In addition, *golden-2*, a mutation on chromosome 3, is known to result in defective cellular differentiation of bundle sheath and mesophyll cells in maize leaves. Taken together, research of *golden-2* and this chromosome transgenic study of oat-maize addition lines indicate that maize chromosome 3 may be involved in bundle sheath formation critical to C4 photosynthesis.

15. ERK ACTIVATION MEDIATED BY SHORT CHAIN PHOSPHOTIDIC ACID ^{BBB}

Matthew Duval and Joe Provost
Minnesota State University, Moorhead, MN

When the α_1 - adrenergic receptor is activated, phospholipase D (PLD) is stimulated and ERK phosphorylation occurs. PLD converts phosphatidylcholine to choline and phosphatidic acid, PA. Previous experiments have shown that the addition of primary butanol blocks the formation of PA, and ERK phosphorylation. This suggests that PA is involved in the activation of the Ras/ERK signaling pathway. To investigate the role of PA in ERK phosphorylation, two short-chain phosphatidic acids were used, 1, 2-Dihexanoyl-sn-Glycero-3-phosphatidic acid and 1, 2-Dilauroyl-sn-Glycero-3-phosphatidic acid causing greater response. Additional experiments will be done with a caged short chain PA permeates inside the cell and does not simply activate the pathway through a cell membrane receptor. These experiments provide clear evidence that PA activates the Ras/ERK signaling pathway, validation the previous inhibitor experiments. Future experiments will be performed to determine the exact location where the PA signal enters the Ras/ERK pathway.

16. ISOLATION OF GENES RESPONSIBLE FOR PHENOTYPIC PLASTICITY IN THE GRAY TREE FROG *HYLA VERSICOLOR* ^{BBB}

Lisa Fattkether, BreAnna Ruter and Craig Tepper
Cornell College, Mt. Vernon

Organisms respond to their environment in a variety of ways. Over generations, populations may undergo adaptive evolutionary change as a result of natural selection. Within a generation, individuals may adapt to their environment by initiating developmental changes.

The ability to respond developmentally is known as phenotypic plasticity. Our lab is interested in a respond developmental switch in tail morphology seen in numerous tadpole larvae of the gray tree frog, *Hyla versicolor*. These tadpoles are capable of switching from a grayish shallow-tailed fin to a red deep-tailed fin in response to byproducts released by dragonfly larvae feeding on other tadpoles. Re deep-tailed tadpoles tend to be less susceptible to predation than their gray shallow-tailed brethren. The inducing cues and the gene regulating the developmental tail switch have not been identified.

Our lab has begun to isolate genes that may regulate the developmental switch from shallow to deep tail fins in tadpoles of the gray tree frog, *H. versicolor*. We have created a subtraction library produced from induced and non-induced tadpoles 4 and 8 days following their exposure to feeding dragonfly larvae. This library contains cDNA inserts and the DNA sequence of the clones.

Identifying genes that regulate this developmental shift from shallow to deep tails is the first step toward understanding the mechanism by which environmental cues are translated into developmental changes.

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

H. Friberg¹, K. Lyons¹, H. Ross-Suits¹, A. Stegeman¹, M. Dean¹ and T. Tauer²

¹Department of Chemistry, ²Department of Biology, Coe College, Cedar Rapids

Pectinaria gouldii, commonly known as the trumpet worm or ice-cream cone worm 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. Probes constructed from partial sequences of proteins isolated from cement extractions were used to probe the 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 cDNA sequences analyzed via bioinformatics software and published to GenBank.

18. EFFECTS OF RAP1 ON THE SMALL G PROTEINS RAC1 AND CDC42: A POSSIBLE ROLE FOR RAP1 IN CELL CYCLE CONTROL ^{βββ}

Amy Gaviglio and J.L. Cruise

Department of Biology, University of St. Thomas, St. Paul, MN

The small G-protein Rap1 is closely related to Ras, which has been shown to play important roles in cell proliferation and cancer. Most functions of Rap1, and its interactions with other proteins, remain uncharacterized. Recent research has suggested that Rap1 may interact with a subset of Ras downstream effectors, in particular the Rho family proteins Rac1 and cdc42. Using various Rap1 expression vectors and pull-down assays to trap GTP-bound Rho-family proteins, we found that the overexpression of active Rap1 in epithelial and fibroblastic cells caused a decrease in the activity of both Rac1 and cdc42. Conversely, the opposite effect on activity was seen in cells transfected with a dominant-negative form of Rap1. Preliminary data using the same Rap1 expression vectors indicates that active Rap1 may also alter the cell cycle. Rap1 has recently been shown to be involved in integrin-mediated cell adhesion to extracellular matrix. Integrin signals are known to influence cell cycling, and both Rac1 and cdc42 are required for the cytoskeletal rearrangements needed for cell motility and division. The inactivation of these proteins by Rap1 may influence progression through the cell cycle. These results suggest a potential mechanism of action for the small G-protein Rap1 that impinges on cell motility, adhesion, and proliferation.

19. ALLOPARENTAL CARE AND FILIAL CANNIBALISM IN A WILD POPULATION OF FATHEAD MINNOWS (PIMEPHALES PROMELAS) ^{βββ}

Katie R. Geray, Jessica N. Heck, Sarah Y. Skolness and Michelle Malott

Departments of Biology and Chemistry, Minnesota State University, Moorhead, MN

Fathead minnows (*Pimephales promelas*) are a widely studied species of fish in a variety of fields that exhibit interesting reproductive behavior. Female fathead minnows prefer to lay eggs in nests already containing eggs (alloparental care); thus males benefit from guarding nests already containing eggs in order to attract females. To maintain reproductive fitness, males may exhibit filial cannibalism by consuming either allo-sired or self-sired eggs in their nest. Microsatellites are useful genetic markers that can be used to determine genetic diversity and parental assignment in a given species and the polymorphic nature of microsatellite markers is useful in estimating the number of parents contributing to a population of offspring. In this research proposal, we wish to determine if, and to what extent, alloparental care and filial cannibalism occur in a wild population of fathead minnows by applying microsatellite analysis using Polymerase Chain Reaction (PCR), Li-

Cor DNA Analyzer, and Li-Cor GenemagIR genotyping software. We hypothesize that male fathead minnows of the Budd Lake, MN population will exhibit alloparental care and filial cannibalism, however, to what extent is unknown.

20. CHROMOSOME TRANSGENICS IN OAT-MAIZE ADDITION LINES: IMMUNOCYTOLOGICAL ANALYSIS OF THE C4 PHOTOSYNTHETIC ENZYME PEPC ^{βββ}

Rachel Hansen

Saint Mary's University of Minnesota; Winona, MN

Oat-maize chromosome addition lines have been successfully generated for mapping purposes by the University of Minnesota. Addition lines are oat plants (C3 photosynthesis) that include one or more chromosomes from maize (C4 photosynthesis). Oat-maize addition lines are now available for every maize chromosome, 1 through 10. These oat-maize addition lines may be useful to determine the extent to which individual maize chromosomes contribute to C4 photosynthesis. Investigations have been conducted that focus on chromosome transgenics of C4 enzymes. The activity of maize genes within the oat genome has been analyzed using antibodies against maize enzymes involved in C4 photosynthesis. The initial enzyme investigated was phosphoenolpyruvate carboxylase (PEPc), known to be critical in the C4 photosynthetic pathway of maize. Polyclonal antibodies against the PEPc enzyme were prepared and used in Western blots on protein leaf extracts from oat-maize addition lines. PEPc was observed in the oat-maize chromosome 9 addition line, verifying the location of the PEPc on chromosome 9 of maize. A monoclonal antibody against PEPc was subsequently generated for immunocytological experiments. Indirect immunofluorescence with the anti-PEPc monoclonal antibody and a secondary antibody linked to cascade blue was conducted on microtomed sections of leaf tissue from the oat-maize addition line 9. The results showed widespread PEPc gene expression among leaf mesophyll cells of the chromosome 9 addition line. Indirect immunochemical experiments with a secondary antibody linked to colloidal gold particles and enhanced with silver supported these results. In both cases, little or no PEPc enzyme was detected in normal oat plants or other oat-maize addition lines. Enzyme assays conducted with protein extracts from leaf tissue of the oat-maize addition line 9 also showed PEPc enzymatic activity. These results demonstrate that oat plants containing maize chromosomes exhibit C4 photosynthetic enzyme characteristics.

21. THE ERYTHROPOIETIN RECEPTOR ACTIVATES BOTH PRO- AND ANTI-APOPTOTIC SIGNALING PATHWAYS IN THE PRESENCE OF ULTRAVIOLET RADIATION.

C. Fox and M. K. Henry
Des Moines University, Des Moines

Exposure of cells to DNA damaging agents such γ -irradiation (γ IR), ultraviolet radiation (UVR), or antineoplastic drugs (i.e. doxorubicin or cisplatin) cause a number of cellular responses that include cell cycle arrest and apoptosis. Activation of the growth promoting cytokine receptors, such as the interleukin-3 receptor (IL-3R) or erythropoietin receptor (EpoR), overrides DNA damage-induced cell cycle arrest and suppresses DNA damage-induced apoptosis. Here we examine the effects of UVR on myeloid cell survival in the presence of the growth promoting cytokines IL-3 and Epo. Factor dependent mouse myeloid cells (32D) stably transfected with the wild type erythropoietin receptor [32D-EpoR(wt)] were less sensitive to UVR-induced death in the presence of IL-3 or Epo as compared to cells cultured in the absence of cytokine. Using receptor mutant constructs and specific pharmacological inhibitors, we identified multiple cytokine-activated signal transduction pathways which regulate resistance to UVR-induced death. Cytokine-activation of both JAK2 and PI3K signaling pathways decrease the sensitivity of cells to UVR-induced death, while STAT5 appears to have no effect. In contrast to JAK2 and PI3K signaling, activation of the Ras/Erk pathway appears to increase the sensitivity of myeloid cells to UVR-induced death. Identification of signaling pathways which regulate DNA damage-induced death may further our understanding of mechanisms used by cancer cells to evade chemo- and radiation therapies that induce DNA damage.

22. IDENTIFICATION OF NEURONAL PROTEIN BINDING TARGETS OF THE PSEUDORABIES VIRUS GE PROTEIN.

A. M. Holbrook¹, M. Wise¹, K. J. Ross¹, C. H. Hengartner², N. Patterson¹ and B. A. Lenzmeier¹
¹Buena Vista University, Storm Lake; ²Princeton University, Princeton, NJ

The pseudorabies virus (PRV) is an alphaherpesvirus that infects rat neurons. As new PRV virions are being synthesized, the viral envelope glycoproteins are initially sent through the endomembrane system to the host cell plasma membrane. The assembly of new PRV virions requires the endocytosis of these glycoproteins and the PRV gE transmembrane glycoprotein is required for this process (Tirabassi and Enquist, 1998, *J. Virol* 72: 4571-4579). We are presently carrying out a yeast 2-hybrid genetic screen to identify proteins expressed in rat hippocampus neurons that are putative binding targets of the c-terminal cytoplasmic domain of the gE protein. C.H. Hengartner generously supplied us with a

yeast expression vector for a GAL4 DNA binding domain – gE protein (**amino acids 476-588**) fusion protein. We have transformed this vector into yeast and amplified a cDNA library generated from rat hippocampus neurons that will be used to screen for putative PRV gE binding targets. Since the gE protein is conserved in all herpesvirus family members, our findings might be applicable to herpesviruses that cause disease in humans.

23. PRODUCTS THAT BLOCK ADHERENCE OF CANDIDA TO VAGINAL EPITHELIAL CELLS (VEC)

Cara Hollmer, Michael Essmann and Bryan Larsen
Des Moines University, Des Moines

Pathogenesis of mucosal microorganisms depends on adherence to the tissues they infect. For *Candida albicans*, cell surface hydrophobicity is thought to relate to tissue binding ability. However, direct tests involving tissue would require a biopsy specimen use of buccal cell as surrogate indicators. A continuous cell line of VEC, provided by Dr. Kevin Ault (University of Iowa), are grown in Keratinocyte Serum Free Medium with supplements. VEC grown in 50 ml culture flasks were examined daily after planting and showed morphology similar to basal cells. Because in vivo, vaginal cells respond to estradiol, we added estradiol to culture media and showed that this treatment increased VEC proliferation, but did not alter VEC morphology. To demonstrate *Candida albicans* binding to VEC, we stained the fungal cells with fluorescein isothiocyanate and applied them to freshly harvested VEC. A flow cytometry method was developed to distinguish between VEC autofluorescence and fluorescence due to *Candida* binding to VEC. Significant yeast binding to the VEC was observed. We determined by propidium iodide staining of VEC that VEC integrity declined significantly over 24-72 hours and all VEC were subsequently used immediately after harvest. Pretreatment of VEC with several commercially available intravaginal products diminished the amount of *Candida albicans* binding to the VEC. This mirrored the effect of these products on binding of styrene beads to yeast in prior studies. We concluded that components of these intravaginal products may decrease fungal adherence in humans.

24. IDENTIFICATION OF YEAST GENES IMPORTANT FOR CHROMOSOME TRANSMISSION

Heidi Sleister, Stephanie Leeson, Sarah Fatland, Denisa Bellani, Eric Scolaro, Abby Wood and Chris Young
Biology Department, Drake University, Des Moines

Accurate transmission of chromosomes during cell division requires that chromosomes are fully replicated and free of damage prior to cell division. Furthermore, cellular processes that separate chromosomes must be functional. As part of an effort to identify proteins important for chromosome transmission, we implemented a genetic screen in the yeast

Saccharomyces cerevisiae that allows for visual detection of mutants with an increase in the loss of an ADE2-marked yeast artificial chromosome (YAC). This screen resulted in 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, forward mutation frequency, and cell morphology. Mutants were also tested for sensitivity to high salt, caffeine, hydroxyurea, and benomyl. The results elucidated mutant phenotypes that will facilitate cloning the wild-type genes that are altered in these mutants. To this end, high copy suppressors of ysm83 and ysm84 have recently been isolated.

25. CREATION OF A GENETIC ASSAY FOR STUDYING CHROMOSOME BREAKAGE IN THE YEAST *SACCHAROMYCES CEREVISIAE*.

J. J. Lurz, B. Case and B. A. Lenzmeier
Buena Vista University, Storm Lake

tRNA genes are located in evolutionarily conserved sites of chromosome translocation in yeast, yet there is no direct evidence that they act as preferential chromosome breakage sites. We previously used a direct repeat recombination assay to demonstrate that CCG/CGG trinucleotide repeats isolated from a patient with Fragile X Syndrome induce chromosome breakage in yeast (Lenzmeier *et al.*, in preparation). This assay, however, did not provide conclusive evidence for breakage at tRNA genes. We are exploring further the potential role of tRNA genes in causing chromosome breakage by creating yeast artificial chromosomes (YACs) that can be used in a genetic assay to identify DNA fragile sites (Callahan *et al.*, 2003, *Mol. Cell Biol.* 23: 7849-7860). If the YAC undergoes a chromosome breakage event in the vicinity of the putative fragile site, the break is healed by telomere addition and the cell will lose its sole functioning copy of the marker gene *URA3*, thereby generating a cell that is now resistant to the drug 5-FOA, which kills cells that express the *URA3* gene product. We have cloned a known DNA breakage element (CCG/CGG trinucleotide repeats) and the putative tRNA gene breakage site into the YAC and are presently carrying out the genetic assays to determine relative rates of chromosome breakage.

Additional Copies of the Proceedings of the 117th Annual Meeting of the Iowa Academy of Science may be purchased for \$5.00.

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26. THE ROLE OF THE CELL CYCLE CONTROL GENE *CDC28* ON MITOCHONDRIAL INHERITANCE

BBB

Kyle Marthaler
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Mitochondria function to provide cells with energy for all metabolic processes. Throughout the cell cycle, mitochondria are highly dynamic. They continuously move about and change shape depending on which state of the cell cycle they are in. This process is termed mitochondrial dynamics. In *Saccharomyces cerevisiae*, inheritance of mitochondria from mother cell to daughter bud during cell division is an essential feature of the yeast cell growth. The analysis of mutants defective in mitochondrial morphology and inheritance has led to the identification of some of the proteins that control mitochondrial dynamics. We are interested in understanding how mitochondrial inheritance is coordinated with the cell cycle. We plan to generate specific mutations in genes that regulate the cell cycle in yeast. We will be focusing on the *CDC28* gene that encodes a protein that drives a cell through mitosis. Our strategy is to use a variety of molecular techniques including PCR in order to generate a "knockout" construct. We will then observe these yeast cells by staining mitochondria and scoring their morphology. Any cells with defects in morphology will give us clues as to how this cell cycle regulator controls mitochondrial inheritance.

27. CHARACTERIZATION OF THE *FOOL'S GOLD* ZEBRAFISH MUTANT.

BBB

J. W. Brittingham, T. Ireland, L. Miller and L. Saunders
Simpson College, Indianola

Neural crest cells contribute to an array of diverse cell populations in vertebrate animals. Melanocytes and xanthophores are neural crest-derived pigment cells that must be properly specified, migrate to the appropriate embryonic positions, survive and differentiate in order to direct the correct pigment pattern in the zebrafish, *Danio rerio*. Mutations in genes involved in any one of these mechanisms may result in abnormal pigment patterns. The zebrafish, is an ideal system for large scale mutagenesis in the search for genes which control development. A mutant strain, called *fool's gold* was identified in such a screen for pigment cell pattern defects in the zebrafish, (Cornell & Eisen, 2000). This mutant demonstrates a defect in the neural crest derived xanthoblast pigment cell population as exhibited by a reduction in the number of yellow pigment cells in the mature fish. The goal of this project is to characterize the phenotype of this mutant in an effort to understand the cellular and molecular nature of the defect. Whole mount in situ hybridization methods were employed to characterize alterations in the expression pattern of pigment cell-specific gene products in these mutants. These efforts will shed light on the complex regulatory

mechanisms that are responsible for directing the fate of a subset of neural crest cells that are responsible for the complex pigment patterns observed during zebrafish development.

28. ASSESSING GENETIC DIVERSITY OF PIMEPHALES PROMELAS IN BUDD LAKE USING PCR-BASED MICROSATELLITE ANALYSIS.^{βββ}

Diane L. Nelson, Jill A. Moes, Laura L. Matzke and Michelle L. Malott
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Fathead minnows (*Pimephales promelas*) are a freshwater fish with a wide geographic distribution. We are specifically interested in the fish population found in Budd Lake in Itasca, MN. By using a molecular approach to study genetic variation in the population, we are able to further investigate the reproductive behavior seen in fathead minnows. We are using Polymerase Chain Reaction (PCR) to examine specific regions of the DNA called microsatellites. This is allowing us to develop genetic "fingerprints" for these minnows and this information is being used in concurrent studies in our lab examining the reproductive behavior of these fish. We will show our DNA fingerprinting data and provide a preliminary conclusion about overall levels of genetic variation in this population of fathead minnows from Budd Lake, MN.

29. IS MITOCHONDRIAL INHERITANCE TISSUE SPECIFIC? A NEW LOOK AT THE MTDNA DOGMA FROM A CELL BIOLOGY PERSPECTIVE.^{βββ}

Jennifer Risan, Michael Schiff, Lisa Magstadt and Lisa Streitz
Minnesota State University, Moorhead, MN

Mitochondria play a critical role in the generation of metabolic energy (ATP) in eukaryotic cells. ATP is essential in driving many of the reactions that take place on the body. The role of a mitochondrion is to maximize and control the production of ATP. Furthermore, these cytoplasmic organelles make their own circular DNA, which is referred to as mitochondrial DNA (mtDNA). It is important to note that there is a distinction between nuclear DNA and mtDNA. While nuclear DNA encodes most of the proteins that drive mitochondrial processes, some critical ATP-producing enzymes are encoded in the mitochondrial genome. Mitochondria are extremely important to study because almost any mutation in mtDNA leaves an organism somewhat debilitated, causing mitochondrial myopathy. Mitochondria have been thought to be materially inherited for over twenty years. Results from previous experiments show that a child's mtDNA will be identical to that of the mother. Does this mean that there is no paternally inherited DNA? Perhaps not. However, researchers have mainly focused on testing mtDNA in blood samples. To examine if inheritance patterns differ between tissues,

Heidi Jo Johnson, Austin McCoy and Jen Risan began planning an experimental approach and protocol development to test our hypothesis. Our hypothesis is that blood and muscle tissue will inherit mitochondria from different parents. The approach we are using to test our hypothesis is to sequence the mtDNA taken from two different strains of mice. We will be sequencing mtDNA from the blood as well as from muscle tissue to see if mtDNA inheritance is, indeed, tissue-specific. Currently, we have completed mitochondrial isolation from different tissues and mtDNA extraction from those mitochondria. Verifying the specificity of mitochondria is an important step for figuring out what cellular mechanisms are required to direct the mitochondria into different tissues. This may open a new way of looking at mitochondrial inheritance and ultimately show us how this system is regulated.

30. HETEROCHROMATIN BOUNDARY ELEMENTS AND CHROMOSOME FRAGILE SITES IN THE YEAST SACCHAROMYCES CEREVISIAE

K. J. Ross and B. A. Lenzmeier
Buena Vista University, Storm Lake

Boundary elements are DNA sequences that actively function as transition sites between silent heterochromatic and transcribed euchromatic regions of yeast chromosomes. DNA sequences that are known to function as boundary elements include tRNA genes and retrotransposable long terminal repeats. Although it has not yet been demonstrated directly that these DNA elements are prone to breaking, they are clustered in evolutionarily conserved sites of chromosome translocation in yeast. We hypothesize that the transition between heterochromatin and euchromatin creates an environment that is susceptible to chromosome breakage. Using a genetic assay originally created by Donze and Kamakaka (2001, *Embo J.* 20:520-531), we are analyzing the ability of known DNA fragile sites, such as CGG repeats isolated from a Fragile X patient, to prevent the spread of silent chromatin and act as heterochromatin boundary elements. We are also examining the consequences of mutating yeast genes that suppress genome instability on boundary element activity.

31. EFFECT OF CELL CYCLE INHIBITORS ON MITOCHONDRIAL REPLICATION^{βββ}

Deshna Gurung and Marina Shakya
Minnesota State University, Moorhead, MN

Mitochondria provide most of the ATP that cells use and are critical for a cell's survival. A newly fertilized egg divides millions of times in order to become a new human individual. Some of the key processes required for successful cell division is the replication and correct segregation of DNA and numerous organelles, especially mitochondria. Cell division is coordinated by key protein regulators that precisely guide all the steps

required for a cell to grow, replicate DNA and organelles and finally split up the cellular "goods" and divide. Our lab is interested in understanding how mitochondria are regulated during this process. Observations of yeast mitochondria show that these cells generate approximately two times more mitochondria just prior to division. We plan to use cell cycle inhibitors to block yeast cell in specific stages of the cell cycle. We will then examine these cells to determine if the mitochondria have doubled or paused with the cell. Our studies will help to show if mitochondrial division is coordinated with the cell cycle or is independent.

32. MATRIX METALLOPROTEINASE 9 ACTIVATION THROUGH THE SODIUM HYDROGEN EXCHANGER

βββ

Taves J. M., Wallert M. A. and Provost J. J.
Minnesota State University, Moorhead, MN

Matrix metalloproteinases (MMPs) make up a group of enzymes that play a critical role in digesting the extracellular matrix in tissues. This is a critical function for tumor metastasis and angiogenesis. The relationship between the production of MMPs and the sodium hydrogen exchanger (NHE) has been suggested by several publications but not yet identified. The decrease in extracellular pH is presumed to be responsible for activation of the MMPs or the activation of NHE can induce secretion of the protein through an unknown mechanism. We investigated the relationship between NHE and MMP activity in CCL39 fibroblasts containing NHE1 and in PS120 cells (NHE1 null cells derived from CCL39 cells). We found the production of MMP-9 to be dependent upon the presence of NHE. In CCL39 cells, MMP-9 was produced in the presence of the agonist phenylephrine (PE) and lysophosphatidic acid (LPA). In PS120 cells, no MMPs were produced in the presence of either agonist. This indicates for the first time an agonist-induced relationship between NHE1 and MMPs and describes a new potential role for NHE1 in tumor formation.

33. A NOVEL APPROACH OF ASSESSING EFFECTS OF CELL CYCLE REGULATORY PROTEINS MAD 2/MAD3 DEGRADATION ON MITOCHONDRIAL DYNAMICS USING A TEMPERATURE SENSITIVE PLASMID CONSTRUCT TS-DEGRON.

βββ

Dyan Voge and Sumeda Nendadasa
Minnesota State University, Moorhead, MN

Mitochondrial morphology is a vital component for regulation and maintenance of cellular activities such as aging and apoptosis. The morphological balance is largely a compromise between opposing structural forces; fusion and fission. However other cellular events, especially cellular division, are also closely integrated with mitochondrial morphology. An otherwise, non-essential cell cycle regulatory proteins (Mad2/Mad3) will be degraded in-vivo to further examine the

consequences of cell cycle arrest on the delicate balance of mitochondrial morphology. Previous studies suggest Mad2 and Mad3 to be regulating a key cell cycle checkpoint. Therefore, we hypothesize a regulatory function between these proteins and mitochondrial dynamics. Degradation of the regulatory protein will be accomplished using a temperature sensitive protein flag when subjected to 37C. After cell cycle protein degradation, recombinant yeast cells will be stained with gradient specific dye (DIOC6) and examined to evaluate abnormal mitochondrial morphology.

ORAL PRESENTATIONS

34. STRUCTURAL DETERMINANTS OF VIRULENCE IN COXSACKIEVIRUS B3 RNA.

Johanna M. Missak and William Tapprich
University of Nebraska, Omaha, NE

Coxsackievirus B3 (CVB3) is a positive-sense RNA virus responsible for causing myocarditis, pancreatitis, meningitis and possibly type I diabetes. Virulence has been mapped to the 5' nontranslated region (5' NTR) of the viral genome. The 5' NTR is a highly structured region of the CVB3 RNA thought to mediate internal assembly of the translation initiation complex in the host cell by use of an internal ribosomal entry site. An avirulent, infectious isolate of CVB3 called CVB3/GA contains many nucleotide substitutions from the virulent sequence in the 5' NTR that attenuate virulence and reduce replication of the virus in murine cardiomyocytes. I have used chemical modification followed by reverse transcriptase DNA primer extension to detect solvent-exposed and solvent-protected nucleotides in virulent and avirulent CVB3 5'NTR RNA in order to determine structural differences between these two strains that may account for virulence in the virus.

35. TESTING ORGANIC VERSUS NON-ORGANIC GROWN FOODSTUFFS FOR MUTAGENICITY WITH THE AMES TEST.

βββ

Beth McQuinn
Saint Mary's University of Minnesota, Winona, MN

Cancer is a widespread problem. A contributing factor to this cancer epidemic is suggested by some researchers to be the foods Americans eat; or more specifically, the pesticides and herbicides applied to the foods that we consume. It's well known that most cancers are initiated by mutations of genes. The *Salmonella* Ames assay for mutagenicity is a test to detect mutagens. The Ames assay was used to determine whether a significant difference exists between organic and non-organically grown fruits and vegetables. Organic and non-organically grown fruits and vegetables were obtained from local merchants. Apples were the first foods to be tested. Extracts were made from each of the food samples and tested by the Ames assay. Positive and negative controls were tested simultaneously with the

extracts. ANOVA statistics resulted in a probability of 0.02. Least significant differences (LSD) showed a significantly lesser number of mutations in the extracts from organically grown foodstuffs than the non-organically grown foods ($p=0.01$). Non-organic foodstuffs also showed a greater frequency of mutations than the negative control ($p=0.03$). No statistically significant difference resulted between the negative control and organically grown foodstuffs ($p=0.90$). Similar tests are being conducted for the organically grown potato versus the non-organically grown potato.

36. ESCHERICHIA COLI BECOMES LESS SENSITIVE TO TRICLOSAN AFTER REPEATED EXPOSURE ^{βββ}

Veronica Cantu and Jeanne Minnerath
Saint Mary's University of Minnesota, Winona, MN

Triclosan is frequently used as an anti-microbial agent in hand soaps (Suller and Russell, 2000; Braoudaki and Hilton, 2004). *Staphylococcus aureus* is commonly found on human skin (Madigan, Martinko and Parker, 2002) as is *Escherichia coli* from fecal contamination (Madigan, Martinko and Parker, 2002). Both of these microorganisms are often exposed to triclosan and resistance to this anti-microbial agent is likely. Cross-resistance to other anti-microbial agents may also develop. The two objectives of this research were (1) to determine whether *Staphylococcus aureus* and *Escherichia coli* developed resistance to the anti-microbial agent triclosan following repeated exposures to triclosan and (2) to determine whether repeated exposures to triclosan caused *Staphylococcus aureus* and *Escherichia coli* to develop cross-resistance to other anti-microbial agents, such as antibiotics. The minimum inhibitory concentration (MIC) assay was used to determine the minimum concentration of triclosan necessary to completely inhibit the growth of *Staphylococcus aureus* and *Escherichia coli*. The *Staphylococcus aureus* and *Escherichia coli* isolates were repeatedly exposed to triclosan, and the MIC was reassessed to determine if the bacteria developed resistance to triclosan. Preliminary results indicated that after only five exposures to triclosan, *Escherichia coli* was 100 times less sensitive to triclosan compared to unexposed *Escherichia coli*. However, cross-resistance to other anti-microbial agents was not observed. Similar studies are presently being completed on *Staphylococcus aureus*. These results suggest that repeated exposure to triclosan decreases the sensitivity of bacteria to this commonly used anti-microbial agent.

Inspire future scientists, next year volunteer to be a judge for the Junior Academy!

37. A NOVEL APPROACH OF ASSESSING EFFECTS OF CELL CYCLE REGULATORY PROTEINS MAD2/MAD3 DEGRADATION ON MITOCHONDRIAL DYNAMICS USING A TEMPERATURE SENSITIVE PLASMID CONSTRUCT TS-DEGRON ^{βββ}

Ava-Gaye Simms and Pabalu Karunadharma
Minnesota State University, Moorhead, MN

Mitochondrial morphology is a vital component for regulation and maintenance of cellular activities such as aging and apoptosis. The morphological balance is largely a compromise between opposing structural forces; fusion and fission. However other cellular events, especially cellular division, are also closely integrated with mitochondrial morphology. An otherwise, non-essential cell cycle regulatory proteins (Mad2/Mad3) will be degraded in-vivo to further examine the consequences of cell cycle arrest on the delicate balance of mitochondrial morphology. Previous studies suggest Mad2 and Mad3 to be regulating a key cell cycle checkpoint. Therefore, we hypothesize a regulatory function between these proteins and mitochondrial dynamics. Degradation of the regulatory protein will be accomplished using a temperature sensitive protein tag when subjected to 37°C. After cell cycle protein degradation, recombinant yeast cells will be stained with gradient specific dye (DIOC₆) and examined to evaluate abnormal mitochondrial morphology.

38. PHYSIOLOGICAL AND TRANSCRIPTIONAL RESPONSE OF SACCHAROMYCES CEREVISIAE TO LOSS OF CELL WALL CHITIN ^{ISF}

M.E. Strenk and M. Schmidt
Des Moines University, Des Moines

A rigid cell wall protects *Saccharomyces cerevisiae* from environmental stress and limits the expansion of the cytoplasm. This cell wall consists of major fractions of glycoproteins and glucan and a minor fraction of chitin. Recently, we constructed a *S. cerevisiae* mutant which survives without chitin. Growth and cytokinesis of the mutant are initially severely impaired. The chitin-deficient strain acquires a genetic suppressor which remedies both growth and cytokinesis defect without restoring chitin synthesis. The aim of this study is to characterize the suppressor's impact on cell wall synthesis.

To decide on the mode of inheritance of the suppressor, we deleted the chitin synthase genes in haploid yeast strains. Chitin synthase deficient haploids with and without suppressor were mated and the resulting diploids were assayed for the suppressor phenotype. Although somewhat inconclusive, the results of the mating experiment point to a dominant mode of inheritance.

Microarray analysis showed that the suppressor modulates the expression of comparably few genes. Surprisingly, the gene for $\beta(1,3)$ -glucan synthase, *FKS1*,

was not induced during adaptation to chitin deficiency. This was mirrored by a slight decrease in $\beta(1,3)$ -glucan synthase activity in isolated membranes. It can be concluded that the suppression of the growth defect caused by chitin deficiency is not caused by an increase in the synthesis of the major cell wall component $\beta(1,3)$ -glucan. This study was supported by IAS grant# ISF-04-07.

39. A BIOCHEMICAL ANALYSIS OF SMALL G PROTEIN SIGNALING IN AUTISM. ^{BBB}

Jill M. Skolte, Joseph J. Provost and Mark A. Wallert
Department of Biology, Minnesota State University,
Moorhead, MN

Autism is a pervasive developmental disorder with a collection of behavioral symptoms including, but not limited to dysfunction in social interaction, communication, sensory and motor disturbances and lack of bonding to caregivers. One phenomenon of this disorder is the formation and development of neural synapses. A significant percentage of people with autism display alterations in chromosomes 9 or 15. The genes associated with these abnormalities code for TSC1 and TSC2. These genes code for the proteins hamartin and tuberlin, respectively, and function as a complex which regulates growth, proliferation, migration, and differentiation of many cell types. TSC1 activates RhoA, a small G protein that regulates cytoskeletal structure, important for cell growth and development. Immortalized lymphocytes were obtained from autistic and non-autistic family members to assess the expression of TSC1/2 and several putative downstream signaling partners. Several autistic patients displayed a low TSC2 level, while others had notably higher levels of TSC2 expression compared to the non-autistic cell lines. In autistic patients that have almost no TSC2 expression, RhoA expression is diminished. Patients displaying little or no TSC1, however, did not correlate with the expression of RhoA. Growth factor pathways can be regulated by small G proteins. Therefore, we also checked the level of an important growth factor pathway component, ERK. Although RhoA seems to be linked to TSC2 expression, total ERK in the cell was virtually at the same expression level in the autistic and non-autistic patients. We intend to measure potential changes in activation by determining the state of phosphorylation in these cells. Overall, these results show a possible connection between the level of TSC2 produced in a cell and the expression of RhoA in autistic patients which, if mirrored in neural tissue, could possibly lead to a cascade of events that turn on or off a mechanism in the brain which causes autism. With this research we hope to gain an understanding of one potential biochemical mechanism involved in autism.

40. HYDROXYCINNAMALDAHYDE INDUCES A G1 AND G2/M CELL CYCLE ARREST AND DECREASES HEMATOPOIETIC CELL SURVIVAL.

M.K. Henry, D. Cox, D. Clark, M. Lou, D. Strom and L. Mortensen
Des Moines University, Des Moines

The use of complementary and alternative medicines (CAMs) as possible therapeutics in the treatment of cancer has recently gained attention in Western medicine. A number of herbal extracts have been shown to inhibit cancer cell growth and survival. Here we investigate hydroxycinnamaldehyde (HCA) extracted from cinnamon bark on the growth and survival of transformed hematopoietic cells. HCA has been reported to mediate its growth inhibitory effects through farnesyl protein transferase, FTase. We have previously demonstrated that the FTase inhibitor, hydroxyfarnesylphosphonic acid (HFPA), induces a G1 cell cycle arrest in hematopoietic cells. Further, HFPA does not decrease cell survival at doses as high as 100 M. In contrast to HFPA, we demonstrate that treatment of hematopoietic cells with HCA decreases cell survival and induces a G1 and G2/M cell cycle arrest. Interestingly, the cell cycle inhibitory effects and decrease in cell survival mediated by HCA in hematopoietic cells more closely resembled the effects observed when culturing cells with an inhibitor of the prenyl transferase, geranylgeranyl transferase (GGTase). From our current observations, it appears that HCA does not mediate its effects exclusively through the inhibition of FTase, but may involve the disruption of other proteins important for cell proliferation and survival, such as GGTase. Identification of the precise molecular mechanism by which CAMs such as HCA mediate their effects will further define their chemotherapeutic potential for the treatment of cancers.

41. TEA EXTRACTS INHIBIT GROWTH AND FUNCTIONS OF LEUKEMIC LYMPHOCYTES AND MONOCYTES BUT NOT NORMAL HUMAN BLOOD CELLS.

J. W. Jansen, M. M. Kruth, L. A. Beltz and K. P. Manfredi
University of Northern Iowa, Cedar Falls

Tea, a product of *Camellia sinensis*, is one of the most popular beverages in the world. Its consumption has a number of health benefits, including decreased incidence of cancer rates in high tea-drinking regions. We examined the effects of tea extracts on the functions of leukemic and normal human blood cells. Using the [(3-4,5-dimethylthiazol-2-yl)-2,5-diphenyltetrazolium bromide](MTT) assay, we show that 200 ug/ml of green (Banchar), Oolong, and black (Darjeeling) tea extracts decreased the growth of human Jurkat T lymphocytic leukemic cells, but not the leukemic TUR monocyte line or normal peripheral blood mononuclear cells (PBMC), which contained lymphocytes and monocytes. As little as 25 μ g/ml of each tea extract decreased ³H-thymidine

uptake (DNA synthesis) by Jurkat cells, and at 200 µg/ml, proliferation was reduced by >96%. Using the same assay, TUR cell growth was reduced ~55% by 400 µg/ml tea extracts. Two major components of green tea are epigallocatechin gallate (EGCG) and caffeine. When added to cells, EGCG reduced Jurkat ³H-thymidine uptake and, to a lesser extent, that of TUR cells, while increasing PBMC proliferation. Caffeine was not growth inhibitory for any cell type. Interleukin-2 (IL-2) is a major lymphocyte growth factor. Its production by Jurkat cells was decreased in a dose-dependent manner by all three tea types when tested prior to the time of growth decrease. The addition of exogenous IL-2 to Jurkat cells did not restore their growth. Dietary supplementation with tea or EGCG may therefore be an inexpensive way to prevent leukemia in developing countries.

42. ERK ACTIVATION AND WOUND HEALING THROUGH PHOSPHOLIPASE D IN AN A1-ADRENERGIC PATHWAY ^{βββ}

R.L. Sang, J.J. Provost and M.A. Wallert
Minnesota State University, Moorhead, MN

Phospholipase D (PLD) is believed to play a role in tumor formation in several cell lines, and the inhibition of PLD has been associated with a decrease in changes in cell growth cell invasion, cytoskeletal rearrangements, and cell migration. We report here that the specific α 1 adrenergic agonist, phenylephrine (PE), signals to a growth factor pathway through PLD. Also, PLD has a role in the regulation of wound healing. Addition of 1-butanol inhibited ERK activation by PE, presumably by blocking the formation of phosphatidic acid. Furthermore, we show that primary but not secondary alcohol also blocks the ability of PE to stimulate wound healing. Expression level of PLD isozymes and expression of dominant negative PLD 1 and 2 will aid in identifying the role of the enzyme in adrenergic mediated cell migration, cell proliferation, and cell growth. All of these results together point to a PLD mediated, PE induced ERK growth factor pathway.

43. CHROMOSOME TRANSGENICS IN OAT-MAIZE ADDITION LINES: IMMUNOCYTOLOGICAL ANALYSIS OF THE C4 PHOTOSYNTHETIC ENZYME PPDK ^{βββ}

Megan Multhaupt
Saint Mary's University of Minnesota, Winona, MN

Oat-maize addition lines have been successfully generated at the University of Minnesota for mapping purposes. Addition lines are oat plants (C3 photosynthesis) that include one entire chromosome from maize (C4 photosynthesis). The lines are available for every maize chromosome, 1 through 10. Oat-maize addition lines may be useful in determining the extent to which individual maize chromosomes contribute to C4 photosynthesis. Under certain environmental conditions, C4 photosynthesis is more efficient than C3

photosynthesis. These investigations have focused on chromosome transgenic of C4 enzymes. The activity of maize genes within the oat genome has been analyzed using antibodies against C4 enzymes. The enzyme pyruvate orthophosphate dikinase (PPDK) is one of the critical enzymes in C4 photosynthesis and is not found in the C3 photosynthetic pathway of oat plants. Polyclonal antibodies against the PPDK enzyme were prepared and used in Western blots on protein leaf extracts from oat-maize addition lines. PPDK was observed in the oat-maize chromosome 6 addition line, verifying the location of the *ppdk* gene on chromosome 6 of maize. A monoclonal antibody against PPDK was subsequently generated for *in situ* tests. Indirect immunocytological experiments using a secondary antibody linked to colloidal gold particles and enhanced with silver were conducted on microtomed leaf tissue of the oat-maize chromosome 6 addition line. The presence of the PPDK enzyme was clearly shown in the mesophyll cells. These results demonstrate that C3 oat plants containing maize chromosomes exhibit C4 photosynthetic enzyme characteristics.

44. DETERMINATION OF C4 ENZYME ACTIVITIES IN OAT-MAIZE ADDITION LINES BY ENZYME ASSAYS ^{βββ}

Derek Nelson
Saint Mary's University of Minnesota, Winona, MN

Plant geneticists at the University of Minnesota have generated oat plants that contain one or more maize chromosomes, called oat-maize addition lines. Our laboratories at Saint Mary's University have been provided with seed from these plants. The addition lines have led to investigations involving chromosome transgenics, that is, the study of the activities of genes and enzymes from maize within oat plants. One objective involved the determination of the activity of various enzymes in maize important to the C4 photosynthetic pathway. The initial enzymes of interest included phosphoenolpyruvate carboxylase (PEPc) and pyruvate orthophosphate dikinase (PPDK). The activity of these enzymes in the C4 photosynthetic pathway contributes to high photosynthetic efficiency under certain adverse environmental conditions. Preliminary results from Western blotting and *in situ* immunocytological techniques have shown that the gene for PEPc is found on maize chromosome # 9 and the gene for PPDK is on chromosome # 6. Spectrophotometric enzyme assays of protein extracts from the leaf tissue of oat-maize addition line # 9 have shown significant PEPc activity, and enzyme assays of these extracts have shown significant PPDK activity in oat-maize addition line # 6. Bradford assays have shown total protein content in maize, oat and addition lines to be comparable. This study showed that these C4 maize enzymes were active in oat leaf tissues.

45. ISOLATION AND SEQUENCING OF PATHOGEN RESISTANCE GENE ANALOGS IN NATIVE IOWA PRAIRIE PLANTS.

K. M. Connolly, Z. G. Fang and J. E. Jurgenson
University of Northern Iowa, Cedar Falls

Resistance gene analogs (RGAs) are genes found to have a similar structure to genes known to provide genetic resistance to pathogens that may be viral, bacterial, or fungal. Common sequence elements found in known RGAs have allowed us to use PCR to isolate similar gene sequences from native plants. Using a set of DNA primers known to isolate RGAs in soybean plants, we have isolated DNA fragments from native Iowa prairie plants that have a structure similar to known RGAs. DNA primers LM638 and LM637 were used in a PCR reaction to amplify such sequences from 22 different native Iowa prairie plant species. This DNA was then ligated into the PGEM T Easy™ TA cloning vector. The sequence of the inserts of the resultant recombinant plasmid clones was determined using the Beckman CEQ 8000™ Genetic Analysis System. Comparison of sequences isolated from *Artemisia ludoviciana* (Prairie Sage) to other known DNA sequences, using a NCBI Blast search, revealed that the sequences of DNA isolated from *A. ludoviciana* were similar to resistance genes found in other plants. Resistance gene analogs may be isolated using genetic markers from different species of plants. Genetic markers associated with known resistance genes allow us to find resistance gene analogs in other plant species.

46. ISOLATION OF A PORTION OF THE ACETYL COENZYME A CARBOXYLASE GENE FROM SCHIZACHYRIUM SCOPARIUM

N. E. Patterson, A. K. Rowedder and J. A. Hampton
Buena Vista University, Storm Lake

Segments of DNA from a native prairie plant, Little Bluestem (*Schizachyrium scoparium*) have been isolated, cloned, and sequenced. While attempting to clone portions of the Adenosine DiPhosphate Glucose Phosphorylase (ADPGP) gene, the rate-limiting step in carbohydrate biosynthesis, we serendipitously cloned a portion of the gene for the rate-limiting step in fatty acid biosynthesis, Acetyl CoEnzyme A Carboxylase (ACC). Although the ACC gene sequence was amplified using primers designed to select for the ADPGP gene, we found no homology between the ACC and ADPGP genes. A comparison between the ACC gene in *Zea mays* and our cloned sequence will be shown.



College Science Teaching

POSTER PRESENTATIONS

47. COMMON MISCONCEPTION ON NEWTON FIRST LAW.

Behiye Akcay (Bezir)
University of Iowa, Iowa City

This study examined views of intuitive understandings about Newton first law of motion held by science education doctoral students in the one of the Midwestern University in USA. Newton first law explains that when the stone is dropped, it continuous to move forward at the same speed as the walking person, because (ignoring air resistance) no force is acting to change its horizontal velocity. The participants included five PhD candidate students enrolled in the department of science education at a teacher college. Data were gathered by one open-ended question and follow up interview. The findings in this study show a small group of science education PhD students' worldviews and expose the relationship between their beliefs from everyday life experiences and basic physic concepts. This study shows that most of the PhD candidates even their educated background about physic they still have misconceptions about the motion of objects in Newtonian mechanics. What are the impacts of inquiry-based teacher education program on the beliefs of preservice science teachers in science education?

48. A CASE STUDY OF EXPERIENCES IN INFORMAL SCIENCE SETTINGS AS A SCAFFOLD OF FORMALSCIENCEEDUCATION

Pi-Chu Kuo
Science Education Center, University of Iowa, Iowa City

Informal science education has been more and more important since the emphasis of science literacy in the efforts of recent science educational reforms. The development of science education in informal science settings in the past decade has been seen as parallel to the trend of science educational reform in formal science education. However, the role that informal science settings play in formal science education remains unclear. In this case study, the experience of an American science teacher in a summer camp for Taiwanese high school students gave him helpful reflections on his first year of middle school teaching. Meanwhile, the experiences and observations in the summer camp as counselors also benefit two Taiwanese teachers in rethinking on their teaching philosophy.

ORAL PRESENTATIONS

49. A VIRTUAL LABORATORY AS PREPARATION FOR HANDS-ON LABORATORY

J. L. Bonte

Clinton Community College, Clinton

Through a Title III grant, the Science Department at Clinton Community College has created a Virtual Laboratory. For the past three years, this laboratory has been used by chemistry students to perform simulations of experiments. Examples of experiments include density determinations, flame tests, acid/base and REDOX titrations, gas law experiments, conductivity experiments, electrochemistry experiments, and hydrate experiments. After the students have done the laboratory simulations, they move into the Hands-on Chemistry Laboratory and perform the experiments with real laboratory equipment and real chemical apparatus. Students are asked to complete an evaluation of the experiments, and for the most part are happy with the results. The instructor has observed that as a result of the Virtual Lab experiments, students are better prepared for the hands on portion of the lab and understand the laboratory concepts better. Another advantage of the Virtual Lab is that experiments that are too dangerous or difficult to set up in the hands on lab can be performed in the Virtual Lab: for example, exploding nitroglycerine or half-life determinations of radioisotopes.

50. IS THE EARTH FLAT? A WAY TO DEMONSTRATE SCIENTIFIC PROCESS.

T. C. Gibbons

Clinton Community College, Clinton

One goal of a science course is to teach how scientists conduct studies, form hypotheses, and test them. It is possible to memorize lists of steps, but an example is worth many such lists. In this talk, I will present an abridged version of a slide show that I have created for the purpose of giving such an example. It assumes that someone is using modern scientific methods to study the question of whether the earth is flat.

In the show, a researcher first assumes a flat earth because it looks flat. While presenting this to a meeting, the researcher is badgered by audience questioning into making better observations which falsify the first hypothesis and lead to the conclusion that the earth is curved. But if you cannot travel all the way around, what can you know about the earth's shape on the other side? Questions at later meetings continue to force more detailed tests and attempts to predict new behavior. This simple example is suitable for holding student interest in the topic early in a course. The entire show is available at <http://faculty.eicc.edu/tgibbons>

51. DISCOVERING THE SPECIAL PROPERTIES OF BEZI'ER CURVES

Leon Tabak

Department of Computer Science, Cornell College, Mt. Vernon

The presenter has written software that illustrates attractive properties of Bezi'er curves. The presenter will demonstrate this software and outline exercises through which students can deepen their appreciation of why the curves are so well suited for computer aided design. Architects, artists, and engineers now draw with the help of computers and software. The ideal software will let them draw the greatest possible variety of shapes. With it, they will be able to produce any number of perfect copies of a shape. It will give them the option of placing a shape anywhere on the page, at any scale, and in any orientation. Of course, draftsmen prefer an easy method for specifying forms. Artists want an ability to modify an initial draft. After sketching a new product, engineers would like an automatic calculation of volumes, so that they can know the amount of material required for the product's manufacture. Efficient determination of the location and orientation of each part of a surface will make possible fast generation of shaded images. If all other things are equal, one description of a curve is better than another if it requires less space in the computer's memory. The presenter will use animated constructions of Bezi'er curves to explain the connection between their geometry and their utility.

52. WHAT ARE THE IMPACTS OF INQUIRY-BASED TEACHER EDUCATION PROGRAM ON THE BELIEFS OF PRESERVICE SCIENCE TEACHERS IN SCIENCE EDUCATION?

Hakan Akcay

University of Iowa, Iowa City

The purpose of this study was to find out the inquiry beliefs of preservice science teachers who were enrolled in application of biological class during the 2004-2005 academic years in University of Iowa. Inquiry-based teaching is a central to the National Science Education Standards and the Benchmarks for Science literacy. However, many teachers hesitate to teach science through inquiry because they did not learn this way during their preparation to become teachers now in their own K-12 schools. Moreover, inquiry is a highly effective teaching method that develops students' skills in terms of content and process. Because of this characteristic, it is strongly recommended by state and national science standards. In this class, students will focus upon issues and questions raised by items appearing on T.V., in national and local newspapers, and in popular magazines. The first objective of the class will be formulating questions that these reports suggest. The next objective will be applying biological knowledge and inquiry techniques to answer questions or to resolve issues raised from the printed materials. The issues

identified, the questions formulated, and the answers proposed will be topics for class discussions and for individual and group projects, as well as for personal actions designed for resolving the issues/questions. The class has emphasized learning science content using inquiry activities. Moreover, it serves as a model for inquiry-based science instruction. The primary goal of the class was to increase preservice science teachers' skills in science by starting systemic changes in science instruction.

Eight-teen preservice science teachers were enrolled in this class. They indicated an interest in learning about inquiry oriented science teaching. Their data was used in this study. They worked collaboratively with the other students and science educators, and community members. The qualitative data sources used in this research of the preservice teachers is explaining below:

Definition of inquiry: Preservice science teachers defined the inquiry concept and scientific method at the beginning of the semester and at the middle of the semester in 2005 based on their own practice and course experience.

53. SCIENCE TECHNOLOGY AND SOCIETY PROGRAMS MAKE DIFFERENCE!

Hakan Akcay
University of Iowa, Iowa City

Science, Technology and Society (STS) is a reform in science education. STS emphasizes the interaction between science, technology and society. STS is seen as a promising approach to improving science education in the twenty-first century dominated by technological applications and to address consequent societal issues (Kumar & Libidinsky, 2000). According to NSTA, STS focusing on real-world and current problems which have science and technology components from the students' perspectives, instead of starting with concepts and processes. This means identifying local, regional, national, and international problems with students, planning for individual and group activities which address them, and moving to actions designed to resolve the issues investigated. This provides students to instigate, analyze, and apply concepts and processes to real situations. A good program will have built-in opportunities for the students to extend beyond the classroom to their local communities. Activities should be appropriate for the level of the students and be learner centered. STS should help lay the basis for empowering students so that as future citizens they realize they have the power to make changes and the responsibility to do so. Finally, STS provides direction for achieving scientific and technological literacy for all. The emphasis is on responsible decision making in the real world of the student where science and technology are components.

54. A HARD LOOK AT IOWA SCIENCE EDUCATION: HOW MUCH DEEPER SHOULD WE DIG?

Ken E. Lassila¹, Lita C. Rule¹, Gary Fulton², Bob Driggs³, Janelle Torres y Torres⁴, Mindy Skarda⁵ and Cherin Lee⁶
¹Iowa State University, ²Iowa Valley Community College, ³Kirkwood Community College, ⁴Muscatine Community College, ⁵Southwestern Community College, ⁶University of Northern Iowa

This paper is the report of a committee of educators from six institutions formed January, 2004 to study the transition of students from secondary to tertiary science education in Iowa. The members met several times during the past year, and once with high school science teachers to incorporate their viewpoints. The committee discussed and analyzed the conditions existing in the learning process in our state that make the transition difficult for students, and invited Nobel Laureate Leon Lederman to keynote the 2004 Iowa Science Teachers' Convention. Lederman has long advocated revamping high school curricula to have mathematics and the sciences integrated into a coherent, logical, rigorous, interconnected whole. His successful project with the Illinois Mathematics and Science Academy in Aurora is nationally and internationally known, despite its being about four years old. There have been other schools that have embraced Lederman's approach even before his Illinois project, and these institutions have reported favorable results in terms of entrance exams and in getting women and minorities to take up science careers. Feedback from the Iowa high school science teachers on Lederman's presentation has been quite positive. Currently, four institutions are planning to emulate Lederman's model to improve the secondary-to-tertiary transition of students. The committee is continuing to gather and seek more participation from other educators and institutions to make this change. We strongly recommend that Iowa adopt a coherent statewide approach similar to Lederman's to optimize learning for our students.

Be a science leader. Join an IAS standing committee or serve as chair of a section.



Community College Biologist

ORAL PRESENTATIONS

55. THE BUTTERFLIES OF BELIZE ^{JSF}

C.W. Schutte

North Iowa Area Community College, Mason City

Although Belize has earned a growing reputation as a favored destination for ecological investigations, much remains to be learned about the composition and distribution of the Belize butterfly fauna. Lists of invertebrate groups from tropical regions are potentially valuable to workers pursuing a wide variety of biological studies, including biogeography analysis and community ecology. In association with John Shuey of the Nature Conservancy of Indiana, I was able to travel to Cockscomb Basin Wildlife Sanctuary in southern Belize to collect butterflies for five weeks. In addition to opportunistic capture with hand nets, we trapped butterflies using fruit-baited traps. Five new country records were collected, as well as over 500 specimens of various previously recorded species. During the period of 1995 to the present, Dr. Shuey's crew spent a total of approximately 29 person/months collecting a total of over 6000 records from Belize. These records represent over half of the data managed in a comprehensive database of Belize butterflies. The current cumulative collection includes 520 species of true butterflies from Belize, with an estimated total species richness of 633.



Conservation

POSTER PRESENTATIONS

56. UTILIZATION OF GOLF COURSES AND OTHER URBAN GREEN SPACES AS AMPHIBIAN REFUGIA

Ann Calhoun

Biology Department, Wartburg College, Waverly

The objective of this study was to examine amphibian use of urban greenspaces such as golf courses as indication of habitat quality. The survey focused on two golf courses, one well established (~65 yr) and one relatively new (5 yr). Since amphibians are frequently viewed as bio-indicators of habitat quality their density and diversity at our study sites will help us understand how these areas play a role in providing adequate habitat in an urban setting. Species present at the new course are of particular interest in order to comprehend how it is functioning as habitat in a successional fashion. Results indicate several anuran species are utilizing habitat provided by both courses—supporting the

hypothesis that habitat conditions are minimally suitable for some amphibian species. Additional species were located at control sites indicating that, while course habitat may be conducive to housing some species, it appears that others may be excluded for reasons still under investigation. Data collected allows us to determine quality of current habitat and provides benchmarks for future research on urban amphibian communities.

57. EARLY TREE GROWTH PATTERNS IN A CONIFER RESTORATION. ^{BBB}

Leigh A. Cooper, Amberbeth VanNingen and Kathleen L. Shea

St. Olaf College, Northfield, MN

As part of the St. Olaf College natural habitat restoration program, two conifer sites were planted with two-year-old seedlings in 1993 and 1999 to establish areas similar in species composition to coniferous forests in northern Minnesota. The purpose of this project was to study early conifer growth patterns, reproductive output and recommendations for future restoration projects. For each tree, we measured height, diameter and male and female cone production. We also took GPS positions of the trees to produce maps with locations of individual trees and measured soil nutrients. Results showed significant differences in tree heights among species, but no significant differences in tree heights between those grown in plastic tree shelters or with fabric mats and those with no initial growth treatments. The shade intolerant jack pines had the tallest and balsam firs had the shortest mean heights. The mortality for the 1993 plot has been less than ten percent. Growth patterns closely matched the linear pattern predicted by a general linear model based on repeated sampling of marked individuals. Few viable seeds were produced in the cones found on the 12-year-old trees. Unless deer herbivory is high, this study suggests that the benefits do not justify the cost of using tree shelters for young conifers. In the future, cone production is expected to increase and red and white pines are expected to dominate the canopy. Continual maintenance will be required to decrease the hardwood seedlings that naturally grow in the area.

58. THE EFFECTS OF BURNING AND MOWING ON DETRITUS AND SOIL FAUNA OF A TALLGRASS PRAIRIE

A. Larimer, C. Mitros, H. Wang and J. Brown
Grinnell College, Grinnell

We investigated the effects of eight years of spring burning and five years of mid-summer mowing on the plant and soil invertebrate community in experimental plots within a 17 year-old reconstructed tallgrass prairie in central Iowa. We quantified the responses of three distinct invertebrate groups: litter arthropods caught in pitfall traps, soil microarthropods, and soil nematodes.

These groups exhibit important interactions with other biota as well as sensitivity to changes in soil and environmental conditions.

The abundance of litter Collembola, specifically Isotomidae, decreased as a result of burning, while ant abundance increased. Burning also significantly reduced nematode abundance in plots. Herbivorous nematodes were found to be the most fire-resistant of the five nematode feeding groups. In contrast, mowing explained the greatest variation in the soil microarthropod community, with a significantly higher number of individuals found in unmowed plots. Mowed plots had significantly lower ANPP and stem density of Asteraceae, while burned plots had significantly higher stem density of the dominant grass, *Andropogon gerardii*, and the legume *Lespedeza capitata*. Therefore, this study reveals the influences of these management practices on both native prairie plants and invertebrates. The opposite effects of burning on different aboveground taxa points to the need for future studies seeking to understand interspecific interactions within the detritus layer. Along with the immediate physical responses of the plots to burning and mowing, more gradual alterations in the underground chemical composition, especially the C:N ratio of soil and roots, may be accountable for variation witnessed within soil invertebrates.

59. AN EXPERIMENTAL TEST OF NICHE THEORY WITH REALISTIC EXTINCTION SCENARIOS

David Losure and Brian Wilsey
Department of Ecology Evolution and Organismal Biology, Iowa State University, Ames

It has long been hypothesized that more diverse systems will contain fewer empty niches than less diverse systems. This is thought to lead to more efficient resource capture in diverse systems through a mechanism known as niche complementarity. Ecological theory also hypothesizes that this mechanism should cause more diverse systems to be less open to invasion than systems with lower diversity. However, observational and experimental tests of this hypothesis have yielded conflicting results. This study attempts to directly test the proposed mechanism, niche complementarity, by which more diverse ecosystems are thought to resist invasion. We varied species evenness, while holding richness constant, in order to vary the diversity of plant functional morphology (height and grass/forb ratio) in experimental plots. The experimental diversity levels used were chosen based on observed values in remnant and restored prairies. We hypothesized, in accordance with standard niche theory that plots containing greater variation in plant functional morphology would be harder for invaders to establish in and therefore experience a lower rate of weed accumulation. In 2004, plots with species mixtures did experience significantly lower rates of invasion than monocultures. However, among the mixtures diversity

(evenness) alone was not a consistent predictor of invasion rate. Increasing the representation of tall forbs in grass mixtures did lower the invasion rate, but adding short forbs and grasses to tall species had no effect. Further sampling will be made in 2005 to develop a better understanding of how species diversity and identity affect invasion.

60. THE MACROINVERTEBRATE COMMUNITY IN A NEWLY CONSTRUCTED WETLAND RECEIVING URBAN RUNOFF: AN EVALUATION OF FACTORS CAUSING SPATIAL VARIATION IN BIOMASS, DENSITIES, AND DIVERSITY

Daniel R. Rosauer and Timothy W. Stewart
Department of Natural Resource Ecology and Management, Iowa State University, Ames

Wetlands are frequently constructed to filter non-point source pollutants from surface waters, reducing inputs to aquatic ecosystems. Although some wetlands are successful in this regard, others don't meet desired objectives because biological communities needed to process pollutants fail to develop. One group of organisms, macroinvertebrates, sequester and process pollutants by consuming organic matter. Macroinvertebrates also stimulate microbially-mediated decomposition by shredding detritus and mixing and oxygenating sediments. By monitoring a wetland's macroinvertebrate community, we can assess its effectiveness in filtering pollutants. In July 2004, we initiated a study of macroinvertebrate community development in a newly constructed wetland in central Iowa. This wetland is designed to absorb pollutants flowing from an urban landscape toward a lake that provides an emergency water source for the city of Ames. Macroinvertebrates were quantitatively sampled from six randomly-selected locations using a Hess sampler. Several additional biological, physical, and chemical features that might influence the macroinvertebrate community were also measured. We detected a positive relationship between coarse particulate matter abundance and macroinvertebrate density. However, macroinvertebrate biomass, densities, and taxonomic richness were low at all locations, suggesting minimal effects of these organisms on pollutants. Potential explanations for low macroinvertebrate abundance and diversity in this 9-month old wetland include 1) insufficient colonization time coupled with low quantities of organic matter, and 2) invasion by benthivorous fish. Future results from this long-term investigation will reveal if fish prevent establishment of a functional macroinvertebrate community, or if resources provided by continued accumulation of coarse particulate matter will compensate for fish effects.

61. SURVEYING PRAIRIES FOR SMALL MAMMALS IN AND AROUND RICE COUNTY, MN. ^{βββ}

Jared Walker Smith

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When determining the quality of prairies, the small mammal populations within them are often overlooked. While prairies can survive as small remnant patches for lengthy periods of time, small mammal populations are more restricted and need larger areas of land to live in. Prairie voles (*Microtus ochrogaster*) are one such remnant population. They are listed as species of special concern in Minnesota and deserve careful monitoring. This study surveys some of the most likely habitats for prairie voles in and around Rice, Goodhue, and Dakota counties in Minnesota by conducting a standard small mammal trapping session of both remnant and reconstructed prairies. Two prairie voles were captured in two of the seven sites surveyed in five isolated prairies, suggesting a sustained, albeit small, population in the area. Remnant populations are especially at risk for local extinction when lack of corridors between prairies inhibits movement. Knowledge of small mammal species present in prairies can help determine the best ways to preserve, conserve, and restore native dry grass prairie.

62. MOVEMENT BEHAVIOR OF GRASSLAND BUTTERFLIES IN MIXED HABITATS OF CENTRAL IOWA ^{ISF}

Ashley A. Wick, Lindsey K. Kneubuhler, David Courard-Hauri and Keith S. Summerville
Drake University, Des Moines

We investigated the movement dynamics of two species of grassland butterfly: *Speyeria cybele* (great spangled fritillary) and *Megisto cymela* (little wood satyr). During the course of the summer of 2004, we marked over 1200 individual butterflies, of which we recaptured roughly 20% on later resamples to the sites. Using this data, we developed a metapopulation model for these species in a mixed prairie/woodland habitat. We then assessed temporal and spatial patterns in the distributions using markovian analysis, and including information on habitat quality and physical characteristics. In this study, we found a number of results which may be of conservation and management importance, including population redistribution within the season of study.

The Iowa Science Teachers' Section (ISTS)
Fall Conference is the state's largest
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Plan to present or attend: October 20, 2005

ORAL PRESENTATIONS

63. EVALUATION OF MACROINVERTEBRATE ASSEMBLAGE STRUCTURE IN A SOUTHWEST IOWA STREAM WITH GRADE CONTROL STRUCTURES

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Over 500 grade control structures (GCS) have been placed in the 22-county loess soils region of southwestern Iowa to slow erosion and protect infrastructure and farmland. These structures, consisting of a vertical sheetpile dam and a downstream apron of rock rip-rap, have caused recent concern that regional fish populations are declining due to restricted movement over GCS. However, since streams in this region are mostly dominated by sand and silt substrates, addition of rip-rap to streams in this area provides a unique surface for colonization by aquatic macroinvertebrates. We sampled 20 sites on Walnut Creek, Montgomery County, IA from July 25 to July 27, 2004 to evaluate differences between macroinvertebrate assemblages found directly on rip-rap at GCS, immediately upstream of GCS, immediately downstream of GCS, and at sites located at least one kilometer from any GCS (n = 5 sites each). Macroinvertebrates were quantitatively sampled with a kick net and associated physiochemical variables were measured at each site. Invertebrates were identified to family and enumerated. Total macroinvertebrate abundance and taxonomic richness were greatest in samples collected from rip-rap of GCS when compared to other sites (p<0.05). Samples from rip-rap sites were dominated by Ephemeroptera and Trichoptera while other sites were dominated by Oligochaeta and Diptera. This research shows that rip-rap composing GCS of the loess hills region provides critical habitat in streams that normally support low macroinvertebrate abundance and diversity. If GCS are designed that allow fish movement, these structures may actually benefit stream fishes by providing increased food resources.

64. THE FRESHWATER GASTROPODS OF IOWA (1821-1998): SPECIES COMPOSITION, GEOGRAPHIC DISTRIBUTIONS, AND CONSERVATION CONCERNS

Timothy W. Stewart

Department of Natural Resource Ecology and Management, Iowa State University

Although gastropods are important members of freshwater communities, the geographic range, ecological requirements, and conservation status of most species are poorly known. To advance this understanding, I used survey data from museums and peer-reviewed literature to summarize knowledge of the species composition and geographic distributions of freshwater gastropods in Iowa. Since 1821, 49 species

of freshwater gastropods have been reported. Families include Valvatidae (4 species), Viviparidae (6 species), Hydrobiidae (6 species), Pomatiopsidae (2 species), Pleuroceridae (2 species), Lymnaeidae (10 species), Physidae (3 species), Planorbidae (11 species), and Ancyliidae (5 species). Based on rarity or absence of recent records and evidence of local extinctions, it appears that as many as 18 species are imperiled or extinct in Iowa, and 7 additional species were much less widespread at the end of the 20th century than formerly. Absence of recent records for some species probably reflects taxonomic confusion and reduced attention directed toward gastropods in recent decades. However, surveys of the Lake Okoboji region from 1915-1960 documented dramatic gastropod population declines and local extinctions associated with habitat degradation. Because similar environmental changes occurred throughout Iowa in the early and middle 20th century, gastropod diversity and abundance probably declined statewide during that time. By comparing data summarized here with data from future field surveys, evidence of restricted or shrinking geographic ranges can be provided, and the true conservation status of Iowa gastropods will be determined. This information is critical for establishing legal protection and action plans for recovery of endangered species.

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

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University of Northern Iowa, Cedar Falls

Amplified fragment-length polymorphisms (AFLP) is being used to study the genetic variation over two generations of the native prairie plants: *Panicum virgatum* and *Coreopsis palmate*. Previous studies have indicated that Genetic diversity of progeny of collected populations of native plants may increase on cultivation. We are using AFLP to assess the degree of genetic diversity in successive generations of these two species. A goal of this project is to conserve the original genetic integrity of donor seed sources by comparing allelic and phenotypic variability within and among populations. Another goal of this project is to study what effect bulking populations within a region has on genetic variation of the succeeding generation. The analysis is performed on DNA is extracted from frozen plant tissue using a diatomaceous earth extraction protocol and analysed using six different AFLP EcoR1 and MSE primer pair combinations. The Beckman CEQ 8000 Genetic Analysis System is then used to detect fluorescently labeled DNA fragments produced by AFLP. Comparison of the fragment patterns generated by individual plants will allow a determination of genetic relatedness within and between various populations and generations of *Panicum virgatum* and *Coreopsis palmate*.

66. IOWA FENS IN THE WETLANDS RESERVE PROGRAM

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In Iowa, the NRCS designates fens as unique habitats eligible for special consideration through the Wetlands Reserve Program (WRP). To develop guidance criteria for future fen enrollment into WRP, four WRP-application sites and 17 WRP-enrolled fens were visited between 14 May and 30 June 2004 to conduct floristic quality assessments and to identify management needs for each site. All but four of the visited fens met the proposed minimum FQA criteria ($FQI \geq 20.0$ & $CC \geq 3.5$) for special consideration through WRP. The vegetation within the sampled fens was hydric, with mean wetness values ranging -1.4 to -3.8 (FAC+ to FACW+). Shannon's evenness among CC values by site ranged 79% - 94% and were positively correlated with the NCC, TCC, NFQI, and TFQI. Twenty-three exotic plant species and thirteen protected plant species were identified during this study. Differences between NCC and TCC, and NFQI and TFQI values indicate that exotic plant species were exerting significant pressure on the native fen plant communities. The presence of protected plant species was positively correlated with coefficient evenness, native species richness, NCC, NFQI and TFQI. The parameters exhibited before a protected plant species occurred within our sample were coefficient evenness ≥ 0.88 , NCC ≥ 4.2 , and NFQI or TFQI ≥ 26.4 . In addition, *Euphydryas phaeton*, the Baltimore checkerspot, was located on three of the WRP fen easements.

67. A MODEL OF GRASSLAND BUTTERFLY MOVEMENT IN KUEHN CONSERVATION AREA, DALLAS COUNTY, IA

David Courard-Hauri, Ashley A. Wick, Lindsey K. Kneubuhler and Keith S. Summerville
Drake University, Des Moines

Using individual mark and recapture (IMR) techniques, as well as path-following movement studies, we have investigated the behavior of the common grassland butterflies *Speyeria cybele* (great spangled fritillary) and *Megisto cymela* (little wood satyr), and developed a preliminary numerical model of their movement dynamics. We use this model along with Monte Carlo techniques to produce movement distribution functions in a simulated heterogeneous environment. We indicate how this information can be used for estimates of colonization probabilities in restored prairie systems, as well as to inform management decisions which may involve temporary habitat modification.

68. BUTTERFLY DIVERSITY IN A FRAGMENTED LANDSCAPE: THE ROLE OF RAILROAD RIGHTS-OF-WAY

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Conservationists are recognizing the importance of protecting prairie remnants along railways because they represent a significant amount of unplowed prairie. These small but relatively common remnants are important from the perspective of right-of-way management and aesthetic beauty, but may also help insure a sustainable future for native species by providing important resources for pollinators. Many questions concerning linear habitat (e.g. rail and road rights-of-way) have yet to be answered, including whether they represent source or sink habitat and if they provide additional resources. Butterflies were sampled in 2003 and 2004 at 32 prairie remnants in northwest Iowa to examine the differences in species composition between linear and block (e.g. prairie preserves) habitats. Contrary to our hypothesis, results indicate that linear habitats have greater total butterfly species richness, total species abundance and disturbance-tolerant species abundance than block habitats. Linear and block habitats do not significantly differ in the abundance of habitat-sensitive butterfly species. Correspondence analysis, which examines community composition, clearly separates linear from block habitats based solely on butterfly species abundance. From this we conclude that although linear habitats harbor a different composition of butterflies than block habitats, linear habitats provide important habitat for habitat-sensitive species in Iowa.

69. DISTRIBUTION, ABUNDANCE, AND DIVERSITY OF SOLITARY BEES IN FRAGMENTED TALLGRASS PRAIRIE LANDSCAPES

Chiara J. Hemsley and Stephen D. Hendrix
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Iowa has lost 99.9% of its tallgrass prairie and remaining fragments occur as relatively few preserves and many scattered, small roadside or railway remnants. This fragmentation, along with increased pesticide use and the presence of non-native honey bees, is thought to negatively affect wild bee populations upon which about 80% of Iowa's forbs depend for reproduction. The land that surrounds prairie remnants in Iowa is predominantly farmland that is thought to hold few resources for pollinators like bees and butterflies that can fly long distances. We examined the bee community at thirteen railroad remnants and seven prairie preserves in NW Iowa using pan traps in June, July, and August 2003 and 2004. In the summer of 2003, we collected over 2100 bees at our 20 sites and in 2004 we collected over 4500 bees. We did not find an effect of site type (preserve or

railroad remnant) on bee abundance or species richness in 2003 or 2004. In 2003, there was a significant difference in bee species diversity between preserves and railroad remnants; this was not the case in 2004. Two-way ANOVA's showed significant decreases in abundance, diversity, and richness over the course of both seasons at both site types. These results suggest that 1) pan traps may suffer from increased competition with floral resources as the season progresses, and 2) bee abundance and diversity are more likely to be related to landscape level characteristics at a scale appropriate for the distances bees can forage (up to 2 km).

70. TEMPORAL AND SPATIAL VARIATION OF FLORAL RESOURCES FOR PRAIRIE POLLINATORS IN FRAGMENTED LANDSCAPES

Amber F. Hill and Stephen D. Hendrix
Department of Biological Sciences, University of Iowa, Iowa City

The tallgrass prairie ecosystem in Iowa has been extremely fragmented, with 99.9% of the prairie converted to agricultural uses. Many prairie plant species are now found in small and isolated populations, which are believed to experience shortened long-term population viability. Smaller, linear remnant areas are thought to support less diversity than the larger prairie preserves, and fragmentation is also thought to decrease pollinator diversity. I examined the abundance and diversity of floral resources available to pollinators at prairie preserves and linear railroad remnants in the northwestern ¼ of Iowa to determine variation in their spatial and temporal characteristics. I measured floral resources at the sites by directly counting the number of ramets of each species in flower in 5m X 100m strip transects each month from May until August in 2003 and 2004. The diversity in flowering ramets per unit area showed significant variation between large preserves and small railroad remnants in May and July, but not June and August in 2004. The direction of higher diversity was also variable, with railroads having higher diversity than preserves in May, but preserves having higher diversity in July. In 2003 diversity did not differ significantly between preserves and railroads in any month. Species richness did not differ significantly between the site types (railroad remnants vs. preserves), although some months had marginal differences. Using a related study on wild bees at the same field sites, relationships between bee abundance and diversity and the availability of floral resources are underway.

71. UTILIZATION OF GOLF COURSES AS REFUGIA FOR NATIVE VERTEBRATES

David A. McCullough

Department of Biology, Wartburg College, Waverly

In most urban and suburban areas, golf courses, along with public parks, provide the only remaining large green spaces available to endemic and migratory wildlife. Understanding their ecology and how they are managed should provide us with information as to their importance as refugia within regions of declining natural habitat. The purpose of this study is to examine the effects intensely managed public greens such as golf courses can have on vertebrate populations living on or adjacent to them.

Biodiversity and physical attributes (habitat structure...) of two local golf courses and nearby control (more natural) sites were assessed. Studies thus far indicate that these spaces are being utilized by a variety of native vertebrates and in a comparable fashion to control sites. This is an important step in understanding how local urban green spaces provide resources for native species and how these spaces might be modified to improve refugia quality. Analysis of habitat quality and bio-surveys also allow us to suggest management schemes that will improve the likelihood of these areas being used by native wildlife.



Engineering

ORAL PRESENTATIONS

72. PERISTALTIC TRANSPORT AND MIXING OF PARTICLES IN THE GI TRACT

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Department of Mechanical and Industrial Engineering,
University of Iowa, Iowa City

In a multi-disciplinary study, state of the art engineering tools are applied to understand the physics behind the evolution of physiological systems. A major part of nutrient absorption, mixing and breakdown takes place in the GI tract in the laminar flow regime by the action of peristaltic contraction waves. These complex physiological mechanisms are studied by computational fluid dynamics simulations. An Eulerian Levelset based sharp interface method is used to compute the effects of the moving lumen wall on the fluid mechanics in the duodenum. The transport and mixing of food particles is tracked by a Lagrangian particle tracking method. The formulation includes particle-fluid interaction models. Particle evolution under the action of the peristaltic waves is quantified by the dispersion, spread, mixing, transport and distribution of particles. Mixing of particles with advected species such as enzymes is also quantified. Results show complex dynamics of particle

scatter, clumping and sheet formation depending on the input parameters. Insights are obtained into the mechanics over a wide parameter space influencing mixing and transport in the gastrointestinal tract, including particle size, mass, initial placement of the bolus, frequency and amplitude of the peristaltic wave and wave train effects.

73. FACTORS INFLUENCING MENTAL ROTATION PERFORMANCE

Shan Bao, Linda Boyle, Aaron Bock and Chris Brus
University of Iowa, Iowa City

This study investigated how performance on mental rotation tasks are impacted by object rotation and a person's perceived self-confidence. Two experiments were conducted: (1) a paper based version of the Purdue Spatial Visualization Test: Rotations (PSVT: R) with 245 participants, and (2) a computer based version with 30 participants. Performance measures for each experiment included time on task, self-confidence, and accuracy. Performance worsened on objects with two rotations when compared with objects of only one rotation ($t_{478}=-5.19$, $P<0.05$), and were also poorer on objects with 180 degrees rotation when compared to 90 degrees rotations ($t_{478}=4.06$, $P<0.001$). Cluster analyses revealed that differences in perceived confidence were related to performance. Rotation angle and perceived self-confidence had a significant impact on performance that was not linear. Different strategies used in performing mental rotation tasks need to be considered in developing systems that are based on spatial abilities.

74. DEVELOPMENT OF RESEARCH PLATFORMS FOR COCHLEAR IMPLANT STUDIES

Ketki Shah, Feng Tian and Oguz Poroy

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Cochlear implant is an artificial hearing device designed to restore the sensation of hearing in profoundly deaf people by electrically stimulating the auditory nerve in the inner ear. A study was performed based on the second-generation Clarion[®] Research Interface (CRI-2), which utilizes real-time data exchange links in MATLAB[®] and in Texas Instruments' Code Composer Studio[®]. Software was developed to improve system performance in real-time signal processing, enabling the investigation of new stimulation methods and the study of existing ones. The platform also provides researchers with precise control over the amplitude and pattern of the stimulation delivered to individual electrodes. This makes possible the implementation of psychophysical experiments such as pitch perception and loudness discrimination. Next, MATLAB[®] was used to simulate the way speech is processed in a cochlear implant. In this simulation, speech signals are decomposed into different frequency bands using a bank of band-pass filters, and the envelope of the signal in each band is extracted

using a half wave rectifier and a low-pass filter. This envelope is used to modulate band-limited noise to produce an output for each band. The sum of the output signals of all the bands represents the signal delivered to the inner ear with a cochlear implant, but it can be delivered to a normal-hearing subject via headphones. The simulation will be used to study the effects of maskers (background talkers) on speech intelligibility under various listening conditions, with the ultimate goal of improving speech recognition performance of cochlear implant patients.

75. SYSTEM TO EXTEND THE HEARING CAPABILITIES OF COCHLEAR IMPLANT PATIENTS

Kyle Thureen, Michelle Trannel, James Lewis and Oguz Poroy
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Cochlear implants (CIs) are electronic devices that partially restore functionality of a damaged cochlea in patients with profound hearing loss. Commercially available CI models only allow the patient to listen to two audio sources: the on-board microphone and an auxiliary device. Our design seeks to provide patients with access to multiple audio sources, with on/off and volume control for each individual source. We designed a system that receives several audio inputs and transmits one signal, composed of all input channels at various volume levels, to the cochlear implant. Using a remote control, the patient can set the volume level of each signal. The audio output signal is wirelessly transmitted to the patient's cochlear implant for the patient to hear.

Our design consists of three parts: an audio station, an infrared remote control, and a digital signal processor (DSP). The audio station incorporates signal monitoring, amplification, mixing, and transmission, as well as compatibility for 2-way communication between the audio station and the remote control. The remote control serves as the main source of communication between the user and audio station. The user can select a channel and increase or decrease the volume of that channel as well as selecting the mute option. The DSP is responsible for system control, directing the signal amplification, mixing, and amplitude display. Upon completion of the prototype, we intend to test the device with CI patients to determine its usefulness and effectiveness.

76. ASSESSING THE RELATIVE RISK OF SEVERE INJURY IN AUTOMOTIVE CRASHES FOR OLDER FEMALE OCCUPANTS

John Hill
University of Iowa, Iowa City

Two logistic regression models were used in the prediction of injury severity for individuals who are

involved in a vehicular crash. The models identified gender and age as relevant predictors. Specifically, females and older occupants showed a significantly increased risk of severe injuries in a crash. Further, interactions of older females with other factors such as occupant seat position, crash type, and environmental factors significantly impact the relative risk of being severely injured in a crash. This research revealed that older females nationally had a 1.64 time increase risk in severe injuries when they were the driver. The risk was 1.81 times greater when seated in the front passenger seat. There were differences between the national and Iowa crash data including the age at which females become at a significantly higher risk for severe injury and the relative risk of females and older drivers in general. These findings demonstrate the importance of looking at geographical difference and the impact on older female drivers.

77. DRIVER ACCEPTANCE OF DISTRACTION MITIGATION STRATEGIES: FOCUS GROUP AND SIMULATOR STUDIES

Birsen Donmez
University of Iowa, Iowa City

Driver distraction is a major concern and has been shown to contribute to vehicular crashes. Therefore, investigating ways to mitigate distractions is very important. Driver acceptance of distraction mitigation strategies is crucial if these strategies were categorized in a taxonomy based on levels of automation, type of task being modulated by the strategy, and the strategy initiation. This taxonomy was further developed with focus groups that were conducted to investigate driver acceptance of the various mitigation strategies. The taxonomy guided a driving simulator experiment which evaluated how several mitigation strategies and presentation modalities affect driver acceptance. Older driver accept strategies that directly guide their interaction with their non-driving activities more than middle-aged drivers. Regardless of age, all drivers prefer systems that alert the drivers in a visual mode rather than an auditory mode. The findings suggest that during system development, designers should consider the effects of age, presentation modality and the relation between false system adaptation, trust and system use.

78. DRIVER DISTRACTION AND RELIANCE: ADAPTIVE CRUISE CONTROL IN THE CONTEXT OF SENSOR RELIABILITY AND ALGORITHM LIMITS

Bobbie Seppelt
University of Iowa, Iowa City

This study investigated how drivers manage their reliance on Adaptive Cruise Control (ACC). Two ACC failure types were introduced within specific driving contexts to determine the effect on ACC reliance. Further, a secondary task was included to determine the effect of driver distraction on ACC reliance. A medium

fidelity driving simulator was used to evaluate the effect of driving condition (traffic, rain) and automation (manual control, ACC) on headway maintenance and brake response, measured by reaction time to lead vehicle (LV) braking, number of collisions, and both time headway (THW) and time-to-collision (TTC) at instant of the brake response. Throughout the drive, a continuous (forced-pace) secondary task introduced to determine how an in-vehicle task interfered with the transition between manual and ACC control. The in-vehicle task involved listening and verbally responding to messages related to upcoming restaurants. The results showed that they failure type influenced driver's reliance on ACC with drivers relying more on ACC in traffic periods than in rain periods. Finally, ACC appeared to offer the greatest benefit when drivers were distracted with complex mental tasks in periods of heavy traffic.

79. CONDITION BASED REPLACEMENT MODELS

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The primary goal of this research is to develop sensory-based decision making methodologies for maintenance management by establishing a link between low-level condition monitoring information and high-level replacement decision models. This will be significantly beneficial for large scale systems where replacement decisions depend on health conditions and degradation states of the system constituents. This work is a departure from reliability and condition monitoring approaches. Traditional reliability approaches use statistical lifetime distributions to assess the reliability of a component whereas condition monitoring techniques focus on performing diagnostics and classifying faults. In this work, we develop stochastic degradation models that combine population-specific reliability characteristics with component-specific condition monitoring information to compute remaining life distributions of partially degraded components. Online condition monitoring data, which capture the latest degradation state of partially degrading components, are used to update their remaining life distributions in real time. This provides a comprehensive and accurate assessment of the degradation state of a component. These updated distributions are then integrated with age replacement models to compute long-run average replacement cost curves. Thus, rather than replacing a component once it reaches a specific age, this methodology directly links replacement decisions with the latest degradation state of a component.

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80. MECHANICS OF CARBON NANOTUBES AND THEIR REINFORCED ALUMINUM-BASED COMPOSITES

W. Hou and S. Xiao

Department of Mechanical and Industrial Engineering and Center for Computer-Aided Design, University of Iowa, Iowa City

Molecular methods are used to study the mechanics of carbon nanotubes (CNTs). Both single-walled nanotubes (SWNTs) and multi-walled nanotubes (MWNTs) are considered. The size-dependent Young's modulus decreases with the increasing tube diameter for the REBO potential function. However, we observe a contrary trend if we use other potential functions such as the modified Morse potential and the universal force field. Fortunately, such confliction is only obtained for small tubes within cutoff diameters (3nm for REBO and 1.5nm for others). In light of this prediction, Young's moduli of large nanotubes concur with experimental results for all the potential functions. We also studied temperature and defect effects on the failure strength of CNTs. It shows that vacancy defects have a significant effect on CNTs' strengths. CNT reinforced composites have attracted intensive investigations because of the extraordinary mechanical and electronic properties of carbon nanotubes; however, most of research on advanced composites containing carbon nanotubes has focused on polymer-based composites. Studies on carbon nanotubes in metals have taken place much less. In this paper, we use the bridging domain multiscale method to study the deformation mechanisms of CNTs reinforced aluminum-based composites. Different alignment and orientation of carbon nanotubes will be considered.

81. MULTISCALE MODELING OF PARTICLE-SOLIDIFICATION FRONT DYNAMICS

J. W. Garvin, Yi Yang and H. S. Udaykumar

Department of Mechanical and Industrial Engineering, University of Iowa, Iowa City

The interaction of solidification fronts with embedded micron-sized particles can result in pushing or engulfment of the particles by the front. Such interactions are important in several applications, including metal matrix composite manufacture, frost heaving, and cryobiology. For example, in the processing of metal-matrix composites, embedded particles are deliberately introduced into a metallic melt so that they may serve as a reinforcement mechanism for the final solidified sample. The particle embedded in the melt need to be uniformly distributed in order to provide such reinforcing properties and to ensure continuity of the mechanical properties throughout the composite. The development of the solidified microstructure in such systems depends on complex interactions between non-planar solidification fronts and multiple particles. The particle-front interaction is a

multiscale process as the dynamic interactions in the nano-scale gap between the particle and the front play in an important role in the overall evolution of the system at the microscale. For a particle of the order of microns in size or greater, the solution of the Navier-Stokes equations in the nano-scale gap between the particle and the solidification front would be impossible due to the fine mesh requirement needed. An embedded model is therefore developed that capture the dynamics in the gap and hence eliminates the need to solve the Navier-Stokes equations in the small gap region. The solution to the embedded model is coupled to the flow and temperature field outside the gap that is solved using the Navier-Stokes equations.

82. DENDRITE-PARTICLE INTERACTION NUMERICAL SIMULATION

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Understanding the physics behind dendrite-particle interactions is very important to the production of Metal Matrix Composites (MMCs). The numerical simulation is carried out using a level-set method based sharp interface approach which allows the tracking of the solid-liquid interface as well as the particle in a sharp manner. The property differences across different phases are taken care of in a sharp manner with ease. Dendrites grow from a pure under-cooled melt. When the dendrite approaches the particle, appropriate conditions are applied at the particle-solid interface before and after contact. The evolution of the dendrite shape is closely examined as the dendrite approaches and grows around the particle. Some of the previous theoretical studies about planar solidification front and particle interaction predict that for a particle-melt thermal conductivity ratio $k_p = k_l < 1$, the particle is going to get pushed. The present numerical simulation, however, shows that for a thermal conductivity ratio $k_p = k_l < 1$, the solidification front does not get close enough to the particle to activate the particle pushing mechanism. Instead, the solidification front chooses to go around the particle, and eventually the particle is engulfed by sidebranches. This result is contrary to that observed in theoretical treatments where a planar front interacts with a particle and indicates that solidification front-particle interactions may need to be further examined to understand particle-front interactions in cast metal-matrix composites.

83. A NANOSCALE MESHFREE PARTICLE METHOD

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Since meshfree particle methods have advantages on simulating the problems involving extremely large deformations, fractures, etc., these methods become

attractive options to use in the hierarchical multiscale modeling to approximate a large number of atoms. We propose a nanoscale meshfree particle method with the implementation of the quasicontinuum technique. The intrinsic properties of the material associated with each particle will be sought from the atomic level via the Cauchy-Born rule. The studies of a nano beam and a cracked nano plate will show that such a hierarchical modeling can be beneficial from the advantages of meshfree particle methods. Furthermore, the cohesive zone approach is implemented into the developed nanoscale meshfree particle method to study the mechanism of crack propagation at the nanoscale. The temperature effects are also considered by introducing the concept of free energy into the meshfree particle method. The verification of the proposed method is demonstrated by the comparison of the results from both the nanoscale particle method and molecular dynamics.

84. MODELING EFFECT OF SURFACE HETEROGENEITY ON THIN FILMS USING A DISJOINING-PRESSURE PRECURSOR-FILM APPROACH

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University of Iowa, Iowa City

A computational study is reported of the instability and growth of fingers on liquid films driven over heterogeneous surfaces. Computations are performed using a variation of the precursor-film model, in which a disjoining pressure term is used to introduce variation in static contact angle associated with surface heterogeneity. The formulation is shown to yield results approaching the prediction of the Tanner-Hoffman-Voinov dynamic contact angle formula for sufficiently small values of the precursor film thickness. A modification of the disjoining pressure coefficient is introduced which yields correct variation of dynamic contact angle for finite values of the precursor film thickness. The film fingering instability is examined both for cases with random variation in static contact angle and for cases with ordered stripes of different static contact angle. For the cases with random static contact angle variation, the surface inhomogeneity is characterized by the correlation length and variance of the static contact angle variation from its mean value. Wavelength and growth rate of finger-like projections of the driven liquid film are examined for different types of random and ordered static contact angle variation, and the results are compared to predictions of the linear stability theory for the homogeneous surface.

85. UNLOCKING THE SCIENTIFIC VALUE OF NEXRAD WEATHER RADAR DATA

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Modern NEXRAD weather radars, which are primarily used for weather forecasting and prediction, generate massive amounts of valuable information useful to researchers in hydrometeorology and hydrology. This data can be used to predicate rainfall rates and flooding risks. Unfortunately, the operational system was not designed for the data archiving, querying, and analysis required for hydrology research. This presentation will discuss the technical challenges in archiving and making available to researchers this important data set, including issues in terabyte-scale data management, metadata generation and storage, and interaction with scientific analysis tools. An initial working prototype is functioning at the University of Iowa. The investigators have recently been funded by NSF to provide the science community with ready access to the vast archives and real-time information collected by the national network of NEXRAD radars.

86. FATE OF ANTIBIOTICS AND PHARMACEUTICALS IN WASTEWATER TREATMENT PLANTS

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University of Iowa, Iowa City

The prevalence of antibiotics, pharmaceuticals and other "emerging pollutants" in U. S. streams has recently been documented. Several pollutants, potentially posing a risk to human and ecosystem health, were detected in the study. The current literature offers little information to assess the fate of these pollutants in wastewater treatment plants (WWTP) and in WWTP biosolids, yet WWTP could be significant release points for these chemicals into the environment. Expecting that releases of these pollutants can be reduced through improved WWTP operation and optimized land application of biosolids, the following hypotheses will be presented and relevant research results will be discussed: 1) Nonprescription drugs, prescription drugs and 4-nonylphenol will be detected at various stages of wastewater treatment at the Iowa City WWTP; 2) Conventional wastewater treatment processes will have little effect on these pollutants, but diurnal and seasonal climatic patterns will affect the detected amounts; and 3) Anaerobic digester sludge and treated biosolids will contain significant quantities of these pollutants relative to untreated wastewater and the treatment plant effluent.

87. INTERACTION OF A PUMP IMPELLER AND AN INTAKE VORTEX

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The intake of liquid into a pump orifice commonly leads to generation of an intake vortex within the pump bay. Interaction of this intake vortex with the spinning pump impeller leads to oscillatory loading on the impeller, resulting in vibration of the pump shaft and undesirable noise. In this paper, we present a direct numerical simulation of the periodic chopping of the intake vortex by a pump impeller. The computations are performed for an axial pump flow using a finite-volume method, with a mesh that spins with the impeller. The effect of vortex strength and axial velocity magnitude on the vortex-induced chopping force acting on the impeller blade is investigated, and the results are compared to predictions of a correlation previously developed by the authors for the vortex-induced force on a flat plate passing through a vortex core.

88. PREDICTION OF MAXIMUM SPREAD RATIO FOR DROPLET IMPACT ON A SOLID, SMOOTH SURFACE

Brett Bathel
University of Iowa, Iowa City

Normal droplet impact on a smooth quartz surface is investigated. Several previously put forth models are compared with experimentally obtained results for droplet maximum spread over a wide range: (1) impact speeds ($1.2 \text{ m/s} < V < 3 \text{ m/s}$), (2) initial droplet diameter ($2.8 \text{ mm} < D < 3.9 \text{ mm}$), and (3) Reynolds and Weber numbers ($4500 < R_c < 12000$ and $80 < W_c < 485$). Droplet images were collected using a high speed digital camera recording at ~ 2200 frames per second with an image plane spatial resolution of $\sim 16 \mu\text{m}$. Based on the large amount of data collected, a statistical analysis is performed to account for error contribution in model prediction and to determine experimental repeatability. Relative mean error in model prediction ranged from 46.5% and 2.9%.



Environmental Science & Health

POSTER PRESENTATIONS

89. RELATIONSHIPS BETWEEN FISH COMMUNITY AND STRUCTURAL INDICES IN ASSESSING POPULATION BALANCE WITH A PROPOSAL FOR REGIONAL MODIFICATION OF STOCK DENSITY INDICES

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Fish population structure is important in evaluating and managing sustainable fisheries and healthy ecosystems. Indices evaluating population structure such as proportional stock density (PSD) and relative stock density (RSD) and stream health such as the index of biotic integrity (IBI; modified by regional parameters), are tools commonly used by fisheries professionals. These three indices were applied to over 45 samples collected between 1998 and 2004 from 15 reaches of the Turkey, Maquoketa, and Wapsipinicon Rivers in Northeastern Iowa. Analysis compared PSD two recreationally and economically important game fisheries, smallmouth bass, *Micropterus dolomieu*, and channel catfish, *Ictalurus punctatus* to IBI and several associated fish community metrics. We hypothesized that a high score from one index should reflect a high score in the other. Proportional stock density for smallmouth bass ranged from 57 to 9, and channel catfish ranged from 100 to 24; between 30 and 60 are considered to be balanced for both species. IBI scores ranged from excellent condition (77) to poor (22). Correlation between PSD of the two game fish species and IBI was weak. Larger sample collections could yield better results, and a modification to stock density indices to better reflect Iowa fisheries is suggested.

90. USE OF FALLEN TREES FOR SPAWNING BY THE SPOTFIN SHINER (*CYPRINELLA SPIOPTERA*) IN THE UPPER MISSISSIPPI RIVER ^{BBP}

Jennifer Cochran
St. Mary's University of Minnesota, Winona, MN

The spotfin shiner is a crevice spawner that inserts its eggs into large cracks in the substrate. In small streams, it may use crevices among rocks, but it also occurs in large rivers where the substrate is primarily sand. Previous observations have suggested the possibility that spotfin shiners use the bark of fallen trees for spawning in large rivers. The purpose of this study was to investigate the association of spotfin shiners with woody snags in a channel border habitat of the Upper Mississippi River. Three fallen trees in Pool 6 were sampled by electrofishing on three dates during July, August, and October. Spotfin shiners in breeding

condition were the most abundant fish around each snag in July, the peak of the breeding season, but the mean catch declined in August and October. Relative numbers of spotfin shiners and other fish varied significantly among the sample periods. A decline in the use of snags after the breeding season is consistent with the results of a previous study in Pool 6, in which spotfin shiners were not collected close to woody snags during the fall. This suggests that during the summer woody snags are used for spawning rather than for cover.

91. THE COMBINED EFFECTS OF ATRAZINE AND METOLACHLOR ON SURVIVAL RATE, MALE TO FEMALE SEX RATIO AND GROWTH RATES IN *POECILIA RETICULATE*

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Central College, Pella

The affects of commonly used herbicides Atrazine and Metalochlor have been studied to determine their effects on living organisms. However, few studies have looked at the combined affects of these two chemicals. In this study newborn guppies were exposed to either one of the chemicals alone or a combination of the two. The results were compared to an herbicide-free control and to an estrogen control, as these herbicides may be estrogenic. Concentrations chosen were based on levels routinely detected in fresh waters and levels within government allowable limits. Concentrations chosen were: atrazine 3 and 30µg/L; metalochlor 5.25 and 52.5 µg/L and Estrogen 1µg/L. Combined solutions of atrazine and metalochlor were set at both the lower and the higher concentrations for each chemical. Water changes of 20% were made daily and 100% changes were made twice weekly. Water was monitored for pH and DO₂, as these tanks were not aerated. At 90, 120 and 180 days the guppies weight, length and sex (when mature) were measured. Results indicate that exposing these organisms to the lower concentrations of these chemicals alone produces a slight reduction in survival rate, while exposing them to combined low concentrations of these chemicals, as would occur in nature, decreases survival rate to less than 50% of control. These affects were further increased at the higher concentrations. This study emphasizes the need to look at the combined affects of environmental contaminants on living organisms.

92. A SURVEY FOR CHOLESTEROL REDUCTASE ACTIVITY IN PLANTS GROWN IN IOWA.

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Iowa State University, Ames

It has been reported by others that some species of plants and bacteria contain enzyme systems that utilize cholesterol as a substrate and reduce it to coprostanol. Cholesterol reduction has nutritional implications in mammals because the product, coprostanol, is not absorbed into the blood stream. We have developed a

plant tissue disruption protocol and assay system that utilizes ^{14}C -cholesterol in phospholipid micelles as a substrate. The organic extracts following the assay are separated on thin-layer chromatography plates, and the plates are subjected to autoradiography for detection of metabolism of the radiolabeled substrate. Nineteen plant species that commonly grow in Iowa have been screened and the garden pea is the only species evaluated that has utilized cholesterol as a substrate. The end product of the reaction where cellular fractions of pea tissue are utilized is not coprostanol, but 4-cholesten-3-one, which we would have predicted to be an intermediate in the ultimate conversion of cholesterol to coprostanol. The identity of the end product has been confirmed by comparing our sample to commercial standards by using thin-layer chromatography and gas-liquid chromatography systems. Our next phase of research will be to evaluate several varieties of garden peas to determine if other varieties metabolize cholesterol to coprostanol, or if previous researchers misidentified 4-cholesten-3-one as coprostanol. If we can identify a plant that is capable of reducing cholesterol to coprostanol, we will attempt to purify the enzyme. To date, the garden pea is the only species we have studied that can metabolize cholesterol.

ORAL PRESENTATIONS

93. PHOSPHORUS SEQUESTRATION IN WETLAND SEDIMENTS.

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Excess phosphorus (P) loading can lead to eutrophication in water when anoxic sediments release P into the water column. To prevent eutrophication, P may be sequestered in sediments. The fate and transport of P in the Cedar River Watershed wetlands was analyzed by measuring the total phosphorus (TP) of both the water and sediments. The TP in the water column in the wetlands varied temporally from 700 to 1700 $\mu\text{g P/L}$. The TP of the sediment varied spatially from 200 to 700 $\mu\text{g P/gdw}$. The ability for sediments to remove inorganic phosphate was also determined and it was found that, maximum sorption for a variety of sediments collected from the main body of the wetland ranged from 2-9 mg P/gdw . The results suggest that sediments in the Beaver Valley Wetlands are not yet saturated with phosphorus. Thus we examined, in laboratory experiments, the ability of oxidized iron in mine tailings to increase the sequestration capacity of the sediments. We found that under anaerobic conditions, addition of iron mine tailings greatly reduced the amount of total P, dissolved P and bioavailable P (P extracted with 0.02N H_2SO_4) released into the water column. The efficiency of P sequestration was enhanced when acetate was added to the experimental system. The amount of total P released into water under anaerobic conditions was decreased by 5-fold by adding

iron and by more than 20-fold by adding iron and acetate. These results, coupled with measurement of ferrous iron in solution, support the hypothesis that a major mechanism involved in the sequestration of phosphorus in sediments involves the reduction of ferric iron through microbial respiration. The ferrous iron released into water reacts with P to form a precipitate or is re-oxidized to form hydrous ferric complexes that physically sorb phosphorus. In lakes and wetlands, carbon sources and microorganisms are naturally present. Thus adding inexpensive oxidized iron mine tailings to phosphorus enriched wetland inlets or outlets could help increase the sequestration capacity of sediments by increasing the ferrous iron concentration in water and as a consequence, help to prevent P from entering streams, rivers and lakes.

94. DETERMINING THE SOURCE OF FECAL CONTAMINATION IN RECREATIONAL WATERS.

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Cedar Falls

Public health departments carry the responsibility for investigating recreational water-associated disease outbreaks. However, tracking the source of the disease is often problematic because routine monitoring of recreational waters (bacterial counts) is not source specific. The intent of this project was to monitor levels and to determine the source of *Escherichia coli* in a small recreational lake in Iowa. We monitored water samples for *E. coli* and used phenotypic methods to analyze multiple samples of lake water, well water, and known fecal sources. We found moderate to high levels of *E. coli* in lake water samples from the swimming area throughout the summer. We found the highest levels of *E. coli* after rainfall events in both lake water samples and water samples taken from monitoring wells. Phenotypic analyses indicated that the likely source of *E. coli* to the lake in this study included both human and wildlife (geese) fecal material. We also found that the phenotype used to characterize *E. coli* isolated from geese frequenting this lake could not be used to characterize *E. coli* isolated from geese in a neighboring watershed. Identifying the source of fecal material will help authorities implement the proper preventative measures to avoid fecal contamination of the lake in the future.

95. EFFECTS OF ENVIRONMENTAL ESTROGENS ON THE DEVELOPMENT OF THE SOUTH AFRICAN CLAWED FROG *XENOPUS LAEVIS*

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Simpson College, Indianola

Amphibian's highly permeable skin and aquatic nature makes them particularly sensitive to environmental pollutants present in the water and air. Endocrine disrupting chemicals (EDC's) disrupt the development and functioning of the frog's endocrine system when they are introduced into water through agricultural runoff or from effluent from water treatment plants. Environmental estrogens are one type of EDC that affect the development of the frog's reproductive tissues. In an ongoing project we are comparing abnormalities in the reproductive tissue of South African clawed frogs (*Xenopus laevis*) that have developed in local water sources to the amount of estrogen in each water source. We allowed tadpoles to develop in six different environments: Indianola tap water with 1 μ M Estradiol, Indianola tap water with 7 μ M Estradiol, Indianola tap water, Des Moines tap water, water from Cavitt creek in Indianola and water from the Des Moines River. The frogs were allowed to develop until forelimb emergence. The male testes will be sectioned and examined for the presence of oocytes. By examining the impact local water sources have on the reproductive tissues in *Xenopus* we can get a better idea of local water quality and invoke concern in citizens that are not aware of the effect the water could be having on them and their family.

96. THE EFFECT OF PESTICIDES ON HUMAN CELL GROWTH.

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Pesticides are commonly used chemicals in the United States, particularly in the Midwest with its primarily agricultural economy. Atrazine is one of the most widely used herbicides in this region along with metolachlor (herbicide) and diazinon (insecticide). The frequent use of pesticides has led to the contamination of natural water systems and drinking water. In fact, a 1998 NAWQA study that investigated surface and ground water in the United States, atrazine, metolachlor and diazinon were the most frequently detected pesticides. Many pesticides have been shown to have effects on human health including immunotoxicity, genotoxicity, having endocrine system effects including reproductive problems and also being associated with certain types of cancer. The EPA has set regulatory levels for many of these pesticides including the three pesticides used in this study. The focus of our current work is to determine the effects on growth of *normal* human cells when exposed to low concentrations of pesticides. Our

research has shown that atrazine, metolachlor and diazinon are all able to effectively inhibit the growth of normal human cells at concentrations at or below their regulatory levels. Atrazine has been tested alone and in combination with either metolachlor or diazinon. Binary mixtures were also shown to inhibit growth of cells differently than when a single pesticide was present. Additionally, the atrazine metabolites, either alone or in combination with atrazine, decreased normal human cell growth significantly compared to controls. These findings indicate that current regulatory standards for pesticides may not sufficiently protect human health.



Geology

POSTER PRESENTATIONS

97. ANALYSIS OF NUTRIENT SOURCES, ACCUMULATION, AND TRANSPORT AT WEST LAKE IN CEDAR FALLS, IOWA

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The Beaver Valley Wetland system is located north of Cedar Falls in Black Hawk County, Iowa. The watershed is in danger due to the agricultural practices in the area. The land is predominately used for agricultural practices where the application of pesticides, fertilizers and herbicides contribute to many surface and ground water issues within the state of Iowa. If excessive amounts of nitrates and phosphorous are present in a watershed area, loss of oxygen can have detrimental effects to an ecosystem. The area to the north of West Lake, the main lake in this wetland system, was studied during the months of June, July and August, 2004. Both water and sediment samples at the surface and at 15 cm below the surface were collected and then analyzed for total phosphorous and nitrates.

The results were unexpected, although encouraging. The levels were significantly less than what had been found in the area during previous study years, although this particular section of the watershed had not been previously analyzed. There could be two reasons for this: the wetland system is taking the excess nutrients up at a sufficient rate or the nutrients could be flowing through this drainage area without capture until they reach the final sink at the bottom of West Lake. The sediments at the bottom of the lake were not tested during the period of this study. More investigations will be required to analyze P and other excess nutrients movement in the Beaver Valley wetland system.

ORAL PRESENTATIONS

98. SILICIFICATION OF CORALS, STROMATOPORIDS AND BRACHIOPODS AT THE WEATHERED SURFACE WITHIN THE DEVONIAN AGE LITTLE CEDAR FORMATION (SOLON AND RAPID MEMBERS) OF EASTERN IOWA

Adam L. Majeski and Paul Garvin
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Diagenesis of fossils in middle-Devonian limestone was studied at the Troy Mills and Robins quarries in Linn County, Iowa and at the Four County and Ernst quarries in Johnson County, Iowa. Fossils located at the weathered bedrock surfaces are preferentially silicified, and the silicification affects corals, stromatoporids and, to a limited extent, brachiopods, but not other fossils or the host rock. Furthermore, this siliceous horizon extends no more than 3 cm below the weathered surfaces, suggesting that it is an occurrence constrained by these surfaces. Silica for silicification could have come from a variety of sources, including sponge spicules or radiolarian tests, insoluble residues (fine-grained quartz and clay minerals) within the host rock, or from the weathering and alteration of clay minerals contained in Paleokarst-hosted Pennsylvanian fluvial sediment. Once reaching the Devonian weathered surface, a change in pH or other chemical variable could have created an environment favorable to silica precipitation. As silica precipitated, it affected mostly the more porous corals, to a lesser extent the stromatoporids, and only a few of the low-porosity brachiopods. The matrix, and a few other fossil types are wholly unaffected, suggesting that their porosities were too low for quartz fill and/or replacement. The diagenetic sequence is: 1. euhedral calcite void linings 2. poikilotopic megaquartz 3. length-slow filling and replacing chalcedony 4. microquartz. 5. blocky, anhedral calcite. Chert and dolomite are also present, but limited contact with other mineral forms prevented paragenetic information from being determined.

99. STATEMAP BEDROCK GEOLOGIC MAP OF SOUTHEAST IOWA; THE FINAL PIECE OF THE NEW DIGITAL GEOLOGIC MAP OF IOWA

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Iowa Geological Survey

In the Fall of 2004 we completed the mapping of the Bedrock Geology of Southeast Iowa, the last of 7 multi-county maps to be compiled to create a new digital map of the Bedrock Geology of Iowa. The 16-county map includes 12 mapping units within the Pennsylvanian (2), Mississippian (3), Devonian (4), and Silurian (3) systems. The map shows dramatic thinning of Upper Devonian shales from northwest to southeast. New domal structures were mapped in Louisa and Des Moines counties, similar to the Cairo and Columbus City structures in Louisa County. Two fault zones were also

mapped. The Amana Fault Zone is a southwesterly extension of the Plum River Fault Zone, with an opposite sense of movement indicating scissor tectonics. The Iowa City – Clinton Fault Zone is a newly-discovered structural feature that roughly parallels the Plum River system with an opposite sense of displacement (down to the south). A new map of the elevation of the bedrock surface for the region shows the erosional resistance of the Mississippian (especially Burlington Formation) carbonates. These carbonates hold up a prominent escarpment through the eastern part of the region, where early Mississippi River channels and tributaries cut down to the underlying Upper Devonian shales. The map of bedrock elevation also shows that many modern rivers flow preferentially over areas of higher bedrock elevations and avoid pre-existing bedrock valleys.

100. THE LITHOSTRATIGRAPHY AND DEPOSITIONAL ENVIRONMENTS OF THE PELLA FORMATION (MISSISSIPPIAN) IN KEOKUK AND WAPELLO COUNTIES, SOUTHEASTERN IOWA

Beason, Scott R. and Groves, John R.
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The Pella Formation is the uppermost Mississippian rock formation in Iowa, cropping out mainly in the southeastern part of the state. It typically consists of a relatively thin (< 2m) basal limestone that is overlain by thicker (up to 7.5m), highly fossiliferous marl. The Pella Formation rests unconformably on the St. Louis Formation, the upper part of which is nonmarine limestone and plant-bearing sandstone. The top of the Pella Formation is a major erosional unconformity corresponding to the Mississippian-Pennsylvanian systemic boundary. Carbonate petrography of the lower part of the Pella Formation enabled the identification of distinct brachiopodal and oolitic lithofacies that are widely correlatable. Bioclasts increase in diversity up-section and quartz sand decreases in abundance up-section, suggesting that at least the lower part of the formation is a deepening-upward deposit in which restricted marine and then normal marine conditions became established pursuant to transgression of the underlying unconformity surface. The unconformity between the upper Pella Formation and overlying Pennsylvanian rocks is rarely exposed in outcrops because it is bracketed by relatively nonresistant beds that are eroded and covered by vegetation. The unconformity is well preserved in a core from Wapello County. Uppermost Pella beds in the core are deeply weathered and rubbly, which we interpret as paleosol or paleoregolith.

101. THE SEARCH FOR A LOWER MOSCOVIAN (PENNSYLVANIAN) BOUNDARY STRATOTYPE (BIOSTRATIGRAPHIC AND CHEMOSTRATIGRAPHIC CONSIDERATIONS)

Groves, John R.

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Conodonts and fusulinids are the two most widely utilized fossil groups for correlating Bashkirian and Moscovian strata. Conodonts were nektobenthonic and typically achieved widespread distribution. Two lineages that are particularly promising for defining a lower Moscovian boundary are the *Declinognathodus marginodosus*—*D. donetzianus* lineage and the *Idiognathoides sulcatus*—*I. postsulcatus* lineage. Fusulinids, in contrast, were exclusively benthonic and more provincial than conodonts. Although several fusulinid lineages underwent important changes in the Bashkirian-Moscovian boundary interval, the changes are not globally recognizable. Carbon and oxygen isotopes from marine carbonates are not useful as global seawater proxies during the Bashkirian-Moscovian transition because of oceanographic separation of the Panthalassan and Paleotethyan realms: i.e., local oceanographic conditions overprinted global isotopic trends. Strontium isotopes, in contrast, do not suffer from this restriction. Once Sr isotope trends of original seawater composition are calibrated against reliable biostratigraphic events, the Sr curve may become a means for worldwide correlation. The type area of the Moscovian Stage is in the Moscow Basin where in most places an unconformity separates Moscovian from underlying strata, and where in most places uppermost Bashkirian strata lack marine biotas. Accordingly, the search for a lower Moscovian GSSP must extend away from the traditional reference area. Richly fossiliferous and possibly complete successions across the Bashkirian-Moscovian transition are known in the Cantabrian Mountains (Spain), the Donets Basin (Ukraine), the South Urals (Russia), the Taurides (Turkey), Tien-Shan (Kyrgyzstan), and South China.

102. URANIUM-LEAD DATING OF A CORAL FROM THE NEOGENE GURABO FORMATION, DOMINICAN REPUBLIC

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Department of Geology, Cornell College, Mt. Vernon

An extremely well-preserved sample of *Goniopora hilli* from the Neogene Gurabo Formation, Dominican Republic, was dated using U-Pb techniques. In order to screen for diagenetic alteration, $^{238}\text{U}/^{234}\text{U}$ and $^{234}\text{U}/^{230}\text{Th}$ ratios were measured using TIMS in eight chips from this sample and three contained secular equilibrium values for both isotopic ratios. Subsamples from these three chips were dated using $^{206}\text{Pb}/^{204}\text{Pb}$ vs $^{238}\text{U}/^{204}\text{Pb}$ methods to an age of 7.0 MA +/- 0.66 Mya.

Using biostratigraphy, Saunders et al. (1986) and Vokes et al. (1989) assigned significantly different ages to the Gurabo formation (5.1-4.2 Mya and 5.6-5.3 Mya, respectively). Our U-Pb date agrees with new paleomagnetic data which indicate that the Gurabo Formation represents a much longer time interval than previously thought. Thus the rates of faunal turnover during this interval must be recalculated.

103. STABLE ISOTOPIC TRENDS IN 23-16 ka ARKANSAS STALAGMITE

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We present stable isotopic data from a stalagmite (CS-04-01) from Cosmic Caverns, NW Arkansas, that has been dated by U/Th disequilibrium thermal ionization mass spectrometry (TIMS) to 22,800 - 15,700 year BP. The chronology of CS-04-01 is derived from three TIMS dates (22,800 +/- 460, 21,050 +/- 280, and 16,250 +/- 400 yr BP). Carbon isotopic ratios in CS-04-01 average -9 per mil (PDB) between 22,800-21,600 years BP at which time they decrease sharply (over an estimated 300 years) to and remain at an average of -10.5 per mil. This decrease in carbon isotopic ratios could reflect a shift toward a denser forest covering over the cave, or it could also have been driven by a reduction in the contribution of bedrock carbon to the stalagmite. Oxygen isotopic ratios decrease from approx. -4.3 to -5.3 per mil between 21,800 and 20,800 year BP, and then steadily rise to -3.8 per mil at 15,700 years BP possibly in response to 4°C of regional warming during this 5000 year interval.

104. EXPLORING THE ROLE OF THE HYDROLOGIC CYCLE IN CLIMATE MODEL SIMULATIONS OF PAST GREENHOUSE WORLDS

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Sedimentary strata that accumulated in polar regions during the greenhouse climate episode of the mid-Cretaceous Period (120-88 Ma) contain abundant and robust fossil evidence for polar warmth, with mean annual temperatures (MAT) at or above 10° C. Since the inception of this research approach over twenty years ago, supercomputer General Circulation Model (GCM) simulations of the Cretaceous climate system have consistently failed to reproduce this fundamental paleoclimatologic characteristic. A new approach to overcoming this challenge was pioneered in Iowa beginning in 1994, using the $\delta^{18}\text{O}$ values ($^{18}\text{O}/^{16}\text{O}$ ratios) of ancient soil-formed sphaerosiderite (FeCO_3) nodules in buried Cretaceous soils to track mass-balance changes in the Cretaceous hydrologic cycle. Isotopic data collected from mid-Cretaceous paleosols spanning

from Alaska to Colombia are being used for oxygen isotope mass-balance modeling of atmospheric moisture transport in the northern hemisphere, contrasting present conditions from modern meteorological data in the WMO-IAEA Global Network for Isotopes in Precipitation with the Cretaceous data set. The isotope mass-balance model experiments indicate a strong intensification of the Cretaceous hydrologic cycle over that of the modern climate system, with two- to three-fold increases in high-latitude precipitation rates, but also with two- to three-fold increases in tropical evaporation rates. Parallel changes in precipitation-evaporation balances indicate that increased latent heat flux in the hydrologic cycle played a significant role in flattening the equator-to-pole temperature gradient in the Cretaceous climate system. TSW is now involved in GCM experiments to simulate the Cretaceous sphaerosiderite $\delta^{18}\text{O}$ data, with the goal of improving scientific understanding of greenhouse worlds.

105. RESPONSE OF PLEISTOCENE EPIBIONT COMMUNITIES TO TERRIGENOUS SEDIMENTATION ON THE WESTERN AUSTRALIAN COAST

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Fossil reefs from the Last Interglacial (Marine Isotope Stage 5e) are exposed at Red Bluff, Western Australia. Acroporid corals with plate-form colonies dominate the reef framework that is exposed along a marine terrace approximately 5 m thick. Coral plates were systematically removed from the outcrop along a vertical transect, and the epibiont communities preserved on them were examined. Community growth sequences found on these plates were strikingly different from the complex patterns established in the Caribbean and South America, as nearly all plates sustained epibiont growth only to very early stages of succession. Both coarse and fine sediments were plainly observed in association with the coral plates. Epibiont growth persisted during deposition of fine sediment, but ceased after the appearance of the coarser sediment. Petrographic analysis revealed that the sediments are similar in basic composition, but a distinct boundary is present between a coarse-grained packstone and a finer-grained, carbonate mud-rich, wackestone. These differing clasts suggest deposition during respectively high and low energy regimes. Thus, terrigenous sedimentation appears to be an important control on epibiont community structure.

106. TEMPORAL AND SPATIAL VARIATION IN MOBILE SOIL ARSENIC AND THE SELF-ORGANIZATION OF ECOSYSTEMS

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An ecosystem is modeled as a self-organizing system in which the microbial population transfers soil arsenic between mobile and immobile pools in order to promote plant growth and prevent invasion by competing ecosystems. The model predicts that mobile soil arsenic will increase during the dry season and decrease during the rainy season for mollisols that host grasses. Mobile soil arsenic will decrease during the dry season and increase during the rainy season for inceptisols that host woody plants. No seasonal variation in mobile soil arsenic will be seen for inceptisols that host grasses, mollisols that host woody plants, or entisols that host any plants. As a landscape goes through a vegetational succession, mobile soil arsenic will decrease for inceptisols, but will not change for either entisols or mollisols. The above predictions were tested by measuring mobile soil arsenic, soil pH and gravimetric water content across ecosystem boundaries between row crops, perennial pasture, native prairie, shrubland and forest in a mollisol (Rolling Thunder Prairie State Preserve, Warren County, Iowa), and across prairie / shrubland boundaries in an entisol (Behrens Ponds and Woodland, Linn County, Iowa) and an inceptisol (Warren County). Samples were collected during a dry season (September 2003) and rainy season (April 2004) at Rolling Thunder Prairie. Samples were collected during a dry season (September 2004) at Behrens Ponds and Woodland and the Warren County inceptisol, both of which will be re-sampled in April 2005. All results to date have been consistent with predictions

107. THE PALEOECOLOGY OF AN ENCRUSTED DEVONIAN BRACHIOPOD ASSEMBLAGE: CEDAR VALLEY FORMATION, IOWA ^{BBB}

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Since the Paleozoic, encrusting organisms have played a large role in marine ecosystems. When a marine assemblage is preserved in the fossil record, organisms that encrusted hard substrates are preserved in life position. This presents a unique opportunity to study the ecology of the encrusters because the fossil record rarely contains life history data. Preservation includes interactions between encrusters and as well as with their host or substrate.

Five samples of brachiopods were collected from individual horizons within the Solon Member of the Cedar Valley Formation exposed at Robins Quarry, near Robins, IA. Specimens were screened for encrustation

and sorted by genera. Fourteen genera were observed, with seven taxa that were common in most samples. Abundance appeared to be the greatest factor for encrustation, with a strong correlation between abundance and encrustation by taxa. A second factor appearing to affect encrustation was ornamentation; finely ribbed shells were preferred. Encrusters were more abundant on the brachial valve, and most encrusted specimens had multiple encrusters. Preservation of competition was rare, but several cases were found. Comparison between the five samples shows variation through time, although preservational biases may negate these trends.

108. AN HISTORICAL APPROACH TO THE ORIGIN OF CATSTEPS IN THE LOESS HILLS OF WESTERN IOWA

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Catsteps is the regional name for the ubiquitous staircase-like structures seen in the Loess Hills of western Iowa. In other regions, they are called terracettes. Three hypotheses for the origin of catsteps are (1) they are a result of overgrazing, (2) they are remnants of Native American agricultural practices, and (3) they are a natural phenomenon unrelated to human activities. The objective of this study was to use the historical record to decide among the three hypotheses. Catsteps are not described in the journals of Lewis and Clark who visited the Loess Hills in 1804 and 1806. The painter George Catlin visited the Loess Hills in 1832-34. His three paintings "Grassy Bluffs on the Upper Missouri," "River Bluffs, 1320 Miles above St. Louis," and "Floyd's Grave, where Lewis and Clark Buried Sergeant Floyd in 1804," and sketches for the last painting also show no catsteps. On the other hand, catsteps can be seen in a drawing of the Loess Hills found in the book "Iowa as It is in 1856: A Gazetteer for Citizens and a Handbook for Immigrants." Catsteps are clearly visible in five drawings accompanying the 1870 Report of the Geological Survey of the State of Iowa. Since the Loess Hills were sparsely populated prior to the 1870's, the most likely hypothesis is that catsteps are a natural phenomenon, which may be due to the same climate changes of the mid-nineteenth century that promoted the formation of gullies in the period 1860 – 1900.

109. A STABLE ISOTOPIC ANALYSIS OF AN END PLEISTOCENE-AGE STALAGMITE FROM WEST-CENTRAL PORTUGAL ^{βββ}

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We report preliminary results from analysis of a Portuguese stalagmite that has been dated by U/Th alpha spectrometry techniques to ~12,000 – 10,000 yr BP. This stalagmite, ALM-04-04 is 21 cm long, is

composed of clear, coarsely crystalline calcite and was collected from Almonda Cave, in west-central Portugal.

ALM-04-04 was sampled for stable isotopic analysis at 5 mm intervals. Oxygen isotopic values average -3.2 per mil PDB, but vary by ~1 per mil during two discrete intervals. The $\delta^{18}\text{O}$ values of speleothems are determined primarily by the $\delta^{18}\text{O}$ of the infiltrating water and the temperature of the cave. The observed oxygen isotopic fluctuations may represent rapid and large-scale changes in climate, possibly linked to those observed in marine cores.

The carbon isotopic composition of the bedrock hosting the cave averages -2 per mil. Because stalagmite $\delta^{13}\text{C}$ values reflect carbon from both the bedrock and the soil, the -9 per mil stalagmite carbon isotopic value likely corresponds to C3 vegetation over the cave.

110. DEVELOPMENT OF A USER-FRIENDLY EARTHQUAKE RISK ASSESSMENT PROGRAM FOR BUILDINGS IN SAN FRANCISCO COUNTY, CALIFORNIA.

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Financial institutions must wisely assess risk before investing funds. Seismic risk in earthquake-prone areas should be taken into account, yet most financial institutions consider little or no earthquake risk information when evaluating property for investment.

The goal of this project was to design and develop an interactive software platform in which financial institutions, like banks, can query earthquake risk for a particular address or land parcel location. The study area is San Francisco County, California.

Two data types were collected: 1) spatial data, including GIS data layers of land parcels, liquefaction areas, and landslide zones, and 2) non-spatial data such as historic structure failure related to structure materials, stories, and usage. The spatial data was processed and queried in ArcView® software to extract addresses associated with each particular hazard zone. The relevant spatial data was combined with the non-spatial data to create a working database. A custom user form was constructed in Microsoft® Access that allows the user to select a particular address and specify non-spatial attributes. Once the required fields are completed, a report is generated that displays information on the estimated structure failure from an 8.0 magnitude earthquake and seismic risk rating. The seismic risk rating is a simple arithmetic scale that accounts for all the factors found in the database.

To query the custom database, users need to own a registered copy of Microsoft® Access and a computer capable of running the software. The entire data package for San Francisco County, California fits on one compact disc.

111. TRACE ELEMENT AND ISOTOPE SYSTEMATICS OF PHONOLITE AND OTHER ROCKS OF THE CHICO SILL COMPLEX, NE NEW MEXICO

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Alkaline igneous rocks of Chico Sill Complex in northeastern New Mexico fall on the trend of the Jemez lineament. These 37 – 20 Ma intrusive rocks are spatially associated with younger rocks of the Raton-Clayton volcanic field, but clearly sample a different magma source. A subset of the spectrum of intrusive rocks, including phonolite, phonotephrite, trachyte, and lamprophyre, is included in this study and these rocks show overall enrichment in incompatible trace element concentrations. Phonolite was the product of extreme fractional crystallization. Trace element ratios and normalized-element plots suggest that at least two distinct differentiation trends produced phonolite, titanite fractionation played a role in differentiation, and a subduction component is absent from the magma source. One odd feature is the apparent enrichment of Zr as compared to other continental alkaline rock suites.

The subset of rocks studied shows initial Sr and Nd isotope ratios that are close to bulk-earth values, with epsilon Nd in the narrow range of 2.1 to -1.5 ($^{143}\text{Nd}/^{144}\text{Nd}$ between 0.51275 and 0.51256), and initial $^{87}\text{Sr}/^{86}\text{Sr}$ ratios in the slightly broader, but still clustered range of 0.7039 to 0.7060. These isotope ranges are similar to many ocean-island basalts. The trail of the data toward higher $^{87}\text{Sr}/^{86}\text{Sr}$ values suggests a probable mixing curve with granitic or sedimentary rocks of the upper crust, although the degree of contamination must have been small and the contaminant is poorly defined.



Physics

112. STELLAR PHOTOMETRY FROM A DEEP ATMOSPHERE SITE

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We present a technique for stellar photometry utilizing the astronomical equipment at Luther College. We acquire thousands of unfiltered images, typically a few seconds in duration, of a star-rich field each night. Histograms of each star's measured flux are fit with Gaussian curves. We search for single large flux deviations that might arise from an occultation or gravitational microlensing event due to an object passing between the background star and earth. The standard deviations of our Gaussian fits divided by the means of our Gaussian fits, called the flux resolution, provide a measure of photometric quality. Using more than

100,000 images acquired over three years we have determined that the altitude dependent air mass is the primary factor limiting our flux resolution. We have measured flux resolution limits ranging from about .020 for stars at altitudes below 20° to about .006 for stars at altitudes above 75°. Other possible contributors to the flux resolution, including weather and instrument focus have been explored. We discuss the details of our photometric tests and the application of our technique to searches for objects lying beyond the known Kuiper Belt. Our data are also useful for variable star studies and we are examining the possibility of undertaking a search for extra-solar planets, requiring an ability to detect step-like features in stellar light curves at the level of about 1%. Our measured flux resolutions suggest a possible sensitivity to extra-solar planet transits if flux resolution can be maintained over a sufficient time period.



Physiology

POSTER PRESENTATIONS

113. ASSESSMENT OF BAROREFLEX AND CHEMOREFLEX CONTROL OF BLOOD PRESSURE BY CAROTID ARTERY OCCLUSION IN MICE

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Common carotid artery occlusion (CAO) reduces baroreceptor (BR) activity, resulting in reflex vasoconstriction and increased arterial blood pressure (BP). Carotid chemoreceptor (CR) activation due to reduced carotid body blood flow and local hypoxia/acidosis during CAO may contribute to the reflex increase in BP. The goals of this study were to: 1) estimate BR and CR components of the CAO reflex in mice, taking advantage of the ability of 100% O₂ ventilation to suppress CR activity; and 2) determine whether chloralose-urethane (CU) and sodium pentobarbital (PB) anesthesia differentially influence BR and CR components of the reflex. C57BL/6 mice were anesthetized with ketamine-xylazine (IP) followed by either CU (80mg/kg and 0.8g/kg, IV) or PB (50mg/kg, IV). Vagus nerves were sectioned. BP responses to CAO were measured while ventilating the mouse with room air, with 100% O₂, and again with room air. The CR contribution to the reflex was calculated by subtracting the BP response during 100% O₂ from the average BP response during room air. Baseline BP did not differ in mice anesthetized with CU (77±3 mmHg, n=5) and PB (71±3, n=6). BR and CR components of the CAO-induced rise in BP averaged +11±1 and +8±3 mmHg after 25-30 s of CAO in CU-anesthetized mice, and +11±2 and +7±3 mmHg in PB-anesthetized mice. We conclude that BP responses to CAO with and without 100% O₂ ventilation enable quantitative

comparison of BR and CR function in mice, and that the reflex components perform similarly during CU and PB anesthesia (NIH, VA).

114. VASCULAR SYMPATHETIC RESPONSIVENESS MODULATES LOW FREQUENCY BLOOD PRESSURE VARIABILITY (MAYER WAVES)

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Low frequency blood pressure variability (LF_{BP}) has been suggested to reflect sympathetic neuronal activity. We hypothesized that vascular sympathetic responsiveness also affects LF_{BP} . Dose-response curves for blood pressure (BP, femoral artery catheter) and splanchnic sympathetic nerve activity (SpNA, bipolar electrode) were obtained for the α_1 -adrenergic agonist phenylephrine, vasopressin, and sodium nitroprusside in conscious spontaneously hypertensive rats (SHR, n=8, mean BP 136±3 mmHg), normotensive Wistar Kyoto rats (WKY, n=8, mean BP 108±2 mmHg), and 1-clip-2-kidney renal hypertensive WKY rats (1C-2K, n=10, mean BP 130±8 mmHg).

BP response to phenylephrine in SHR was greater than in WKY and greater in WKY than in 1C-2K, whereas the response to vasopressin did not differ between strains. Thus, vascular α_1 -adrenergic responsiveness is specifically increased in SHR and reduced in 1C-2K. SpNA response to sodium nitroprusside was identical in all strains, indicating that sympathetic neuronal responsiveness is not altered in SHR or 1C-2K. LF_{BP} (0.2-0.6 Hz) was larger in SHR (17.4±1.3%) than in WKY (12.1±1.4%, p<0.05) and larger in WKY than in 1C2K (6.3±0.9%, p<0.05).

These data suggest that LF_{BP} depends on vascular sympathetic responsiveness. Thus, for the interpretation of BP power spectra, vascular responsiveness to catecholamines should be considered as well as neuronal sympathetic activity.

115. ISOKINETIC EVALUATION OF THE ANKLE PLANTAR FLEXION AND DORSIFLEXION GENERATED FORCE BEFORE AND AFTER CREATINE SUPPLEMENTATION

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Skeletal muscle contractions can be sustained for only a few seconds because the muscle contains very little ATP. During aerobic activity, ATP is regenerated continually from glycogen and triglycerides. However, during intense exercise when a high rate of ATP hydrolysis occurs, intramuscular creatine phosphate (PCr) converts the accumulated ADP into more ATP. Previous studies have shown Cr supplementation to

increase total intramuscular Cr by approximately 20%. Particularly in type II fast-twitch muscle fibers, PCr regenerates ATP from ADP by transferring its high-energy phosphoryl group which means greater availability of ATP during anaerobic exercise. Force or power may be sustained longer and athletic performance enhanced. Cr supplementation also encourages faster PCr resynthesis during the resting phase after intense exercise, which can decrease the recovery time in between high-energy bursts.

A group of female college volleyball athletes will be subjected to a Cr loading phase of 5 days with 20g/day, followed by a maintaining phase of 5 days with 5g/day. Strength training and conditioning will be incorporated. The population will be tested by the isokinetic dynamometer Cybex II which will provide data regarding the force output of the muscles associated with ankle plantar and dorsiflexion before and after creatine is administered. Our hypothesis is to see an increase in the mean force generated by supplementing creatine. Results of this experiment will be beneficial to student-athletes, athletic trainers, and coaches when considering supplementing creatine. Insight will be gained into whether supplementation could result in training at a higher intensity.

116. POTASSIUM CHANNEL DEFECTS CONTRIBUTE TO DECREASED EXCITABILITY OF NODOSE NEURONS IN SPONTANEOUSLY HYPERTENSIVE RATS

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Baroreceptor and vagal afferent nerve activities are impaired in spontaneously hypertensive rats (SHR). Impairment of these inhibitory afferents contributes to the excessive sympathetic activity in SHR and may lead to hypertension. The aim of this study was to identify ionic mechanisms that could explain at a cellular level the impaired sensitivity observed in vivo. Dil was injected into the adventitia of the aortic arch and a week later Dil labeled baroreceptor nodose neurons were isolated. Depolarizing currents injected into the neurons (1.0 nA for 1 sec) through sharp microelectrodes, elicited action potentials averaging 9.9±3.4 spikes/sec in control Wistar Kyoto (WKY) rats. These responses were enhanced by the stable prostacyclin analog carbacyclin (cPGI) (10 μ M) to 18.4±4.7 spikes/sec (n=12, P<0.001). In contrast, the action potential response to current injections into SHR neurons was negligible, averaging 0.6±0.2 spikes/sec and 0.9±0.3 spikes/sec before and after addition of cPGI, respectively. Thus, baroreceptor neurons of SHR manifest a significant reduction in excitability by failing to trigger action potentials with current injections before and after addition of cPGI. In previous work, we found that cPGI normally excites neurons by inhibiting large conductance Ca^{2+} -activated K^+ (BK) current. Taken together, the results suggest that a defect in BK channels in baroreceptor neurons of SHR prevents their inhibition by prostacyclin, leading to

suppression of neuronal excitability. This mechanism may explain the decreased baroreceptor sensitivity seen in vivo and contribute to neurogenic hypertension in the SHR model.

117. NOVEL MOLECULAR DEFECTS IN MECHANOSENSITIVITY OF AORTIC BARORECEPTOR NEURONS FROM SPONTANEOUSLY HYPERTENSIVE RATS

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We reported that mechanotransduction of baroreceptor neurons (BRNs) is co-mediated in part by mechanosensitive DEG/ENaC channels and by autocrine (prostacyclin) modulation of large conductance Ca²⁺-activated K⁺ (BK) channels. In these experiments, we tested the hypothesis that suppression of BR activity in genetically hypertensive rats (SHR) is caused by abnormalities of these channels. The fluorescent dye Dil was injected into the adventitia of the aortic arch of SHR (n=10) and Wistar-Kyoto rats (n=6). A week later, Dil labeled BRNs were isolated and impaled with a sharp microelectrode. Membrane potential (current clamp), membrane conductance, and the response to mechanical stimulation (with puffs of saline delivered at 10 psi from an injection micropipette) were measured. Resting membrane potential was significantly more negative in SHR (-57.0±2.9 mV) than in WKY neurons (-45.9±1 mV; P<0.05). Membrane conductance was also significantly higher in SHR (42.6±6.2 nS) than in WKY (18.3±3.8 nS, P<0.05) neurons. These differences were partially reversed by iberiotoxin, a blocker of BK channels. Mechanical stimulation depolarized all six WKY neurons by an average of 7.6±4.5 mV. In contrast, SHR neurons depolarized very transiently and/or hyperpolarized with an average change in membrane potential of -5.0±1.7 mV. The failure of SHR baroreceptor neurons to depolarize in response to mechanical stimulation and their greater resting membrane potential and higher conductance suggest that the impaired baroreceptor sensitivity of SHR in vivo results from a defect in mechanosensitive DEG/ENaC ion channels and increased BK channel activity. (HL14388)

118. ABNORMAL HEART RATE AND BLOOD PRESSURE CIRCADIAN RHYTHMS IN HYPERTENSIVE AND HYPERCHOLESTEROLEMIC MICE

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Circadian variations in blood pressure (BP) and heart rate (HR) are altered in patients with cardiovascular disease. We tested the hypothesis that diurnal variations in BP and HR are abnormal in mice with

hypertension (HT) and hypercholesterolemia (HC) due to oxidative stress. Human renin (R⁺) and angiotensinogen (A⁺) transgenic mice, and apolipoprotein E deficient mice (apoE^{-/-}) were bred to generate HT R⁺A⁺ mice and R⁺A⁺/apoE^{-/-} mice with HT+HC. BP, HR, and locomotor activity were measured by telemetry in control (n=10), HT (n=9), and HT+HC (n=7) mice. Mean 24-hour BP was elevated in HT and HT+HC mice (153±4 and 156±2 mmHg) vs. control mice (120±5 mmHg). HT alone decreased diurnal variations in HR and BP (see table, *P<.05 vs. control mice). Blunted diurnal variations in HR persisted, but BP variations increased in mice with HT+HC (table, **P<.05 vs. HT alone).

Diurnal Change	Control	HT	HT + HC
HR (beats/min)	61±6	38±6 *	39±4 *
BP (mmHg)	19±2	14±2	22±2 **

Administration of the antioxidant tempol in drinking water for 4-7 days increased diurnal HR variability in HT (47±9 beats/min, n=7) but not HT+HC mice (33±6 beats/min, n=5). Results could not be explained by differences in locomotor activity. We conclude: 1) Diurnal variations in BP and HR are reduced in HT R⁺A⁺ mice; 2) Addition of HC to HT in R⁺A⁺/apoE^{-/-} mice selectively increases diurnal BP variation; and 3) antioxidant therapy reverses the abnormal diurnal rhythms in HT mice, but this affect is abrogated by HC. (VA, NIH).

119. THE EFFECTS OF AVR-15(AD1051) MUTATION ON LONG TERM MEMORY IN CAENORHABDITIS ELEGANS.

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In the *Caenorhabditis elegans* genome, *avr-15* is the gene responsible for encoding a post synaptic inhibitory glutamate-gated chloride channel subunit (GluClα2) on the pharyngeal muscle. This kind of glutamate transmission has been shown to be critical for the formation of long term memory in *C. elegans*. Previous studies with the *avr-15* gene and neurotransmission have not focused on long term memory, but rather its role in sensitivity to ivermectin, a nematocide. These studies have found that the *avr-15(ad1051)* mutation inhibits this type of neurotransmission that has been shown critical to long term memory, but the link between long term memory and this specific mutation has never been tested. We plan on using a developed protocol to train *C. elegans* to commit a stimulus response to long term memory as has been demonstrated in previous studies using different gene mutations. These studies have employed a mechanosensory stimulus by tapping the side of the Petri dish, eliciting what is known as the "tap withdrawal response." *C. elegans* have been shown to habituate to the tap withdrawal response and for *avr-15(1051)* worms, that habituation is stunted. Twenty-four hours following habituation training, the worms are tested to the same stimulus and the response is

quantified. Less response would show that the worms committed the stimulus to memory, while more response implies that habituation forming into long term memory did not occur. Test results from worms with the *avr-15(ad1051)* mutation will be compared to results from the control group, wild type (*ab-1*) worms.

120. MYOGENIC VASCULAR FUNCTION ASSESSED BY BLOOD PRESSURE VARIABILITY IS IMPAIRED IN SPONTANEOUSLY HYPERTENSIVE RATS

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Myogenic vascular function (MVF) is altered in cardiovascular diseases, such as heart failure and stroke. We tested the hypothesis that MVF is reflected in very low frequency (VLF, 0.02-0.2 Hz) blood pressure variability (BPV) that can be assessed by power spectral analysis. Blood pressure (BP) was monitored (femoral artery catheter) in conscious normotensive Wistar Kyoto (WKY) and spontaneously hypertensive rats (SHR) during control conditions, inhibition of MVF (nifedipine, 5 mg/h/kg, i.v.), and reduction of BP without inhibition of MVF (sodium nitroprusside, 3 mg/h/kg, i.v.).

Mean BP was higher in SHR compared to WKY (122±4 vs. 94±4 mmHg, $p<0.05$). Nifedipine and sodium nitroprusside reduced BP similarly in SHR (-45±11 vs. -43±3 mmHg, n.sig.) and WKY (-32±2 vs. -30±4 mmHg, n.sig.). Contribution of VLF BPV to overall BPV was lower in SHR compared to WKY (43.6±5.3 % vs. 70.0±2.8 %, $p<0.05$). Nifedipine reduced VLF BPV in WKY (-19.3±1.6 %, $p<0.05$) but not in SHR (+14.6±15.2 %, n.sig.). The reduction in VLF BPV in WKY was specific for inhibition of MVF, since sodium nitroprusside did not alter VLF BPV in WKY or SHR. In conclusion, MVF is reflected in VLF BPV. Furthermore, these data suggest that MVF is impaired in SHR because VLF BPV during baseline conditions was lower in SHR than in WKY and since inhibition of MVF reduced VLF BPV in WKY but failed to further reduce VLF BPV in SHR.

121. SUBUNITS OF ACID-SENSING ION CHANNELS (ASICs) DIFFERENTIALLY MEDIATE BARORECEPTOR AND CHEMORECEPTOR REFLEXES

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ASICs contribute to acid-sensitivity and mechanosensitivity of sensory neurons. While ASIC1 and 3 are more acid-sensitive, ASIC2 has been implicated in mechanotransduction (Price et al. 2000, Benson et al.

2002). We hypothesized that ASIC2 through its mechanosensitivity contributes to the baroreflex (BR), whereas ASIC1 and/or ASIC3 through their acid-sensitivity contribute to the chemoreflex (CR). BR and CR were assessed by measuring reflex increases in blood pressure (BP) in response to carotid artery occlusion (CAO) in anesthetized mice during room air ventilation (BR+CR), and after inhibition of CR activity by 100% O₂ (BR only). The CR was calculated by subtracting the response during 100% O₂ from the response during room air integrated over a period of 20 sec. Baseline BP before CAO was similar in all groups, averaging 77±2, 80±3 and 77±5 mmHg in wild-type (WT), ASIC2^{-/-} and ASIC123^{-/-} mice, respectively. The BR and CR responses averaged +298±19 and +94±21 mmHg-sec, respectively, in WT mice (n=6). Corresponding values in ASIC2^{-/-} mice (n=6) were +198±16* for the BR and +242±30* for the CR, and in ASIC123^{-/-} mice (n=4) they were +124±8*† and +46±8*† respectively (* $P<0.05$ vs. WT; † $P<0.05$ vs. ASIC2^{-/-}). In summary: The impaired BR and enhanced CR in ASIC2^{-/-} mice suggest a significant role of ASIC2 in mechano-electrical transduction, and confirm a reciprocal relationship between BR and CR sensitivity. The marked decrease in CR with additional deletion of ASIC1 and ASIC3 suggests that these two subunits contribute predominantly to CR activation. (HL 14388)

122. CHARACTERIZATION OF A NOVEL MICE MODEL OF HYPERTENSION AND HYPERCHOLESTEROLEMIA WITH REDUCED LIFE SPAN

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Hypertension (HT) and hypercholesterolemia (HC) are independent risk factors for development of atherosclerosis and premature death. Patients commonly exhibit both HT and HC. The goals of this study were to create a mouse model of combined HT and HC that would allow assessment of the impact of HT alone, HC alone, and HT+HC on life span, and exploration of mechanisms responsible for decreased survival. Human renin (R⁺) and angiotensinogen (A⁺) transgenic mice, and apolipoprotein E deficient mice (apoE^{-/-}) were interbred to generate HT R⁺A⁺ mice (n=77), HC apoE^{-/-} mice (n=168), R⁺A⁺/apoE^{-/-} mice with HT and HC (n=30), and control mice (n=387). Age-related mortality, defined by Kaplan-Meier plots, was profoundly increased in R⁺A⁺/apoE^{-/-} mice (82.8% at one year vs. 29.0%, 18.5%, and 6.8% in R⁺A⁺, apoE^{-/-}, and control mice, respectively). The increased mortality in R⁺A⁺/apoE^{-/-} mice could not be explained by differences in blood pressure which averaged 116±4, 112±2, 155±4 and 153±3 mmHg in young control (n=7), apoE^{-/-} (n=9), R⁺A⁺ (n=8), and R⁺A⁺/apoE^{-/-} (n=5) mice, respectively. HC was similar in apoE^{-/-} and

R⁺A⁺/apoE^{-/-} mice. We conclude that the combination of HT and HC dramatically reduces life span compared with HT or HC alone. We speculate that oxidative stress mediates the synergism between HT and HC. (VA and NIH).

123. EXPLORING LAMOTRIGINE'S POTENTIAL USE AS A NEUROPROTECTIVE AGENT

N.M. Wilson, L. Hogrefe, E. Musselman and R.L. Dunbar
Buena Vista University, Storm Lake

Glutamate induced excitotoxicity is accompanied by a concomitant increase in intracellular calcium concentration and can be diminished through the application of the anti-convulsant drug, lamotrigine. We hypothesize that lamotrigine's neuroprotection on cerebellar granule cells is acting on voltage-gated calcium channels thus, maintaining intracellular calcium concentrations below lethal levels.

Following successfully culturing cerebellar granule cells in our laboratory, our hypothesis will be tested by comparing cells that have been pre-treated with lamotrigine against those that have not. We predict that intracellular calcium concentrations will be lowered by pre-treatment with lamotrigine. Calcium concentration will be quantified using fura-2 ratiometric imaging. Fluxuations in calcium concentration will be correlated with cell survivability to determine whether lamotrigine does supply neuroprotection against glutamate excitotoxicity and whether lamotrigine's neuroprotection occurs at therapeutically significant concentrations.

Results from these experiments will provide insight into the pharmacological mechanisms of lamotrigine and also allow for the development of new drugs that could improve lamotrigine's mechanism of action. This data will also demonstrate if lamotrigine should be considered as a useful drug in protecting against volume loss witnessed in neurodegenerative diseases and mood disorders.

124. PHYSIOLOGICAL EFFECTS OF GINKGO BILOBA

J. N. Wolff, M. Golnitz and R. L. Dunbar
Buena Vista University, Storm Lake

Ginkgo Biloba has been studied for increasing memory, both long-term and short-term, however the data that has been collected on the subject has been conflicting. Our research aims to gather more data on the hypothesis that Ginkgo Biloba enhances memory as well as look at possible physiological mechanisms underlying this effect. This study will be conducted using volunteers from a college campus, using a double-blind procedure. The volunteers will be evaluated on a weekly basis throughout the four-week duration of the study. The memory component will be assayed using a free recall memory test. The physiological mechanisms being

measured are blood pressure and heart rate. From these tests we are hypothesizing, increased rates of recall in male and female subjects, as well as an increase in resting heart rate, which will be accompanied by a decrease in resting blood pressure. The information gathered from these data will be very helpful to understand how Ginkgo Biloba works. From these data we can design future experiments which will allow us to find out more specifically how Ginkgo Biloba is affecting memory.

ORAL PRESENTATIONS

125. ASSAYS OF HER-2/NEU, ESTROGEN AND PROGESTERONE RECEPTORS, AND FISH RATIOS IN INVASIVE BREAST CARCINOMAS: ACCURACY OF PATHOLOGICAL ANALYSIS IN DETERMINING TREATMENT

Emily Knoble
Mount Mercy College, Cedar Rapids

Breast cancer is the leading cause of death for 40-50 yr old women. For invasive breast cancer, treatment is decided using three pathological assays: Her-2/neu, Estrogen and Progesterone receptors, and Fluorescence In Situ Hybridization (FISH). We determined if these assays were associated. We also determined consistency of pathologists in scoring the Her-2/neu assay.

Data from seventy-three patients diagnosed at Mercy Medical Center in Cedar Rapids, Iowa were statistically analyzed. Data were compiled comparing the ER/PR scores versus the range of FISH scores in three categories. Chi-square analysis compared categories based upon the FISH score below 2.00, of Her-2/neu and ER/PR. Chi-square analysis also compared categories, based upon the Her-2/neu score of 2+/3+, of FISH and ER/PR. The Her-2/neu and FISH scores were also compiled, but a Chi-square analysis could not be performed due to insufficient cases.

Six pathologists were presented nine random Her-2/neu slides, and the ranges of scores were compiled into 95% confidence intervals. The original score was compared with the new score using a one-sample Chi-square test. The comparison between Her-2/neu and ER/PR was not significant ($p=0.178$). The comparison of FISH and ER/PR was significant ($p=0.02$). The pathologist's scoring was not a significant departure from randomness ($0.3 > p > 0.2$). The Her-2/neu and ER/PR scores are not good predictors in determining FISH results, and therefore treatment regimes.



Zoology

POSTER PRESENTATIONS

126. EFFECTS OF PREDATORIAL THREATS ON THE PARENTAL BEHAVIOR OF HOUSE WRENS (*TROGLODYTES AEDON*)^{BBB}

Alyssa M. Anderson

St. Olaf College, Northfield, MN

Birds have developed various survivorship strategies to avoid predation while maximizing foraging efficiency. The purpose of this study was to determine how the parental behavior of the House Wren (*Troglodytes aedon*) is affected by predatorial threats. During the summer of 2004, playback replicates of both female wren scolding calls and raccoon calls were conducted for 18 wren pairs. Of primary interest were the following events: number of feeding trips to the nest box, amount of time spent scanning the territory, number of times the male sang, amount of time the female spent scolding, amount of time spent brooding chicks, and the number of trips made to the box without feeding the chicks. Results for the raccoon playback recordings support the null hypothesis that parental behavior is not influenced by auditory predatorial threats. However, significant differences were found for the scolding playback data, suggesting a lower number of successful feeding trips and a higher number of trips to the box without feeding, as well as a significant increase in scanning time during the scolding playback, thus suggesting an increase in territorial alertness.

127. SEA URCHIN EMBRYOS: MORPHOMETRIC ANALYSIS OF SEPARATED BLASTOMERE-DERIVED EMBRYOS.^{BBB}

J. W. Brittingham, T. Beenken, A. Keller, R. Laughlin, A. J. Lenz, R. J. Metzger
Simpson College, Indianola

Sea urchins (*Lytechinus variegatus*) have many features that make them an important model system for studying development. Sea urchins are deuterostome organisms that demonstrate regulative development, where each cell produced by early cleavage retains the capacity to develop into a complete embryo. This study was designed to compare the differences in growth and development among normally developing sea urchin embryos and those separated at the two-cell stage. Embryos were passed through a fine mesh sieve that mechanically dissociated two cell-stage embryos into single cells. Morphometric analysis was performed on images of separated blastomere-derived embryos and control embryos that had developed to the pleutus larval stages. The embryo's perimeter and crown-to-opposite appendage lengths were measured. Analysis showed

that the separated blastomere-derived embryos had a 28% smaller perimeter. A 26% reduction of the crown-to-opposite-appendage length was also seen. Qualitative analysis supports a regulative development model for sea urchins, as removing a single blastomere from a two-celled embryo does not affect the overall developmental capacity of the embryo. However, this quantitative analysis demonstrates that separated blastomere-derived embryos are significantly reduced in size, implying an incomplete mechanism to compensate for loss of embryonic material at even the earliest stages of development.

128. PRESERVATION OF THE PUTNAM MUSEUM ORNITHOLOGY COLLECTION

Chandler, Christine L.

Putnam Museum of History and Natural Science,
Davenport

The Putnam Museum of History and Natural Science has served as a repository for the natural history of the Quad Cities' area since it was founded in 1867. The Museum's Ornithology Collection includes a significant number of specimens collected in the late 1800s and early 1900s and houses endangered and threatened birds, as well as irreplaceable extinct North American species such as Passenger Pigeons, Carolina Parakeets and Eskimo Curlews. While the Museum has made great strides in improving overall collection storage conditions through environmental controls, the physical storage of the Ornithology Collection was in need of addressing. Modern storage environments must not only protect objects from physical damage but also must allow for easy access to and retrieval of both the actual specimens and their accompanying data. In an effort to create such an environment, the collection was re-housed to meet modern collection care standards. The storage overhaul included the creation of space-saving bases that allow handling without damage to mounts and easy removal of the mounts for study or exhibit purposes. The collection was documented thoroughly using various historical in-house resources such as original catalogs, accession records, specimen labels, etc. All information was entered into the Museum's computerized collection's database, and the specimens were labeled and arranged systematically for easy retrieval from storage.

129. SEXUAL DIMORPHISM IN LIFE HISTORY TRAITS OF A MIGRATORY DRAGONFLY, THE COMMON GREEN DARNER^{BBB}

Paul Decker, Josh Lunski, Tracy Mastel, Sara Skolness and Linda Fuselier
Minnesota State University, Moorhead, MN

Common green darners are dragonflies that exhibit cohort splitting; one cohort matures quickly and migrates in the same season (migrants) while the a second cohort

overwinters and has a longer maturation time (residents). Differences in life history traits between the sexes may influence the probability of an individual following either of the two developmental pathways. We investigated sex differences in mass gain and individual activity for female and male common green darners. An estimate of resident larvae sex ratios was made by sampling larvae from two shallow water habitats in Clay County. We used larvae collected from these habitats in a mass gain experiment and we quantified activity differences between the sexes of final instar larvae. Preliminary estimates of sex ratio from two habitats indicated a trend toward female-bias in resident larvae. Of the residents that we collected, females exhibited a wider range of instars than males. In the mass gain experiment, males gained more mass over one month than females. We are still analyzing results from behavior trials to determine if the sexes differ in activity levels. We predict that males will show higher levels of activity because they tend to gain mass faster than females. As part of this ongoing project, we will collect migrant larvae in the spring, and compare life history characteristics between a larger group of migrant and resident larvae from more locations to better explore sexual dimorphism in suites of life history traits of common green darners.

130. A TEST FOR OLFACTORY RECOGNITION OF PARENTAL ADULTS BY FREE-SWIMMING YOUNG OF BIPARENTAL CICHLID FISH ^{βββ}

Tom Dye, Tony Vadnais and Brian Wisenden
Biology Department, Minnesota State University
Moorhead, MN

Convict cichlid are small freshwater fish native to Central American lakes and streams. They form monogamous pair bonds and jointly prepare and defend a nest. When the eggs hatch, the female and male protect the young from predators for 4 to 6 weeks, until the young are able to live independently. Interestingly, parents often adopt young from other families into their own family. Parents benefit from adoption two ways. First, extra young dilute predator attacks on their own (genetically-related) young. Second, parents selectively adopt only those young that are the same size or smaller than their own. Because the ability to escape predator attack improves as the young grow, and by selectively adopting small young, parents exploit adopted young as preferred targets for predators. How young become separated from their parents and become adopted by another family is not well understood. Here, we test if larval convict cichlids can distinguish their own mother from an unrelated mother (foster parent) or a non-parental female (predator) on the basis of chemosensory cues released by females.

131. STRAUZIA LONGIPENNIS: ONE SPECIES OR FIVE? ^{βββ}

Jessica Harrison and Heather Axen
Cornell College, Mt Vernon

Strauzia longipennis (Diptera: Tephritidae), is well known as a common pest of sunflowers (*Helianthus*); however, its taxonomic status as a species is controversial. The species includes over 20 synonyms. In Iowa, as many as five species of flies have been lumped within *S. longipennis*. Those five species were recognized on the basis of morphological characters and host plant use. Our goal was to test the hypothesis that *S. longipennis* actually comprises several morphologically distinct species. During June and July of 2004 we captured >100 flies from three sites in eastern Iowa (Linn County). Characteristics used to identify species included wing patterns, scutellar markings, and notal stripes. These characters identified three species in our sample: *S. perfecta* (N=19), *S. vittigera* (N=66), and *S. longipennis* (N=17). One of those species, *S. vittigera*, is currently treated as a synonym of *S. longipennis*. To test the hypothesis that morphological characters effectively reveal species, we extracted DNA, and amplified and sequenced the mitochondrial cytochrome oxidase subunit I region of flies chosen on the basis of their distinctive morphological traits. We will use PAUP to analyze the sequence data to find out if the most parsimonious reconstruction based on molecular data reveals the number of taxa suggested by some morphologists.

132. THE ROLE OF OXIDATIVE STRESS IN MATERNAL MTDNA INHERITANCE ^{βββ}

Frank Johnson
Department of Biology, Minnesota State University
Moorhead, MN

During fertilization, the paternal mitochondrial (mtDNA) is not incorporated into the egg. Current research has demonstrated that the paternal mtDNA is degraded by the egg by using targeted ubiquitin-mediated degradation. It was been suggested that during the sperm's travel to the egg, oxidative stress produced by the tremendous ATP output of the sperm mitochondria eventually results in its own damage. Eggs may have developed the ubiquitin mechanism to insure that they future progeny inherit only undamaged mitochondria, and thus to not allow paternal mtDNA to be incorporated into the egg. The purpose of this investigation is to examine the role of oxidative stress on paternal mtDNA using *Xenopus* or *Sea Urchin* sperm. Our studies may help support the theory that oxidative stress leads to ubiquitin-mediated paternal mitochondria degradation.

133. SITES OF COURTSHIP IN TROPICAL FRUIT FLIES (BLEPHARONEURA: TEPHRITIDAE)^{βββ}

J. Johnson¹, J. Gammons¹, H. Axen¹, J. Harrison¹, S. Marsteller¹, M. Nolte¹, L. Adams², A. Santoriello², M. Lewis³, S. Swensen² and M. Condon¹
¹Cornell College, Mt. Vernon; ²Ithaca College, NY; ³Systematic Entomology Laboratory-USDA, ARS

Models of speciation via host shifts most often apply to organisms that court, mate, and reproduce on (or in) their hosts. If populations of those organisms establish on different species of hosts-- and court and mate only on the new host-- gene flow among host specific populations is inhibited. True fruit flies in the family Tephritidae include model organisms for studies of speciation via host shifts (e.g., *Rhagoletis pomonella*, the apple maggot). We study species of *Blepharoneura*, a little known genus of highly host specific tephritid fruit flies. Each species of *Blepharoneura* feeds on a single species of plant, and on a specific part of the plant (e.g., male flowers, female flowers, fruit.) If species that feed on the same species of plant are each other's closest relatives, do those species court and mate on different parts of the host plant? To find out, we will undertake a field study at Jatun Sacha Biological Station (Napo, Ecuador) of four cryptic sympatric species of *Blepharoneura* that feed on flowers of *Gurania spinulosa* (Cucurbitaceae).

134. WING SHAPE IN BLEPHARONEURA (DIPTERA: TEPHRITIDAE): A MORPHOMETRIC APPROACH^{βββ}

Sara Marsteller¹, Dean Adams² and Marty Condon¹
¹Cornell College, Mt. Vernon, ²Iowa State University, Ames

Many species in the genus *Blepharoneura* are cryptic (look alike). Often, multiple sympatric cryptic species feed on the same species of plant. Courtship behavior may be an important reproductive isolating mechanism among such morphologically similar sympatric species. In *Blepharoneura*, courtship involves elaborate wing displays. Wing shape and wing displays may be correlated. We used morphometrics to analyze variation in wing shape in ten species: four sympatric species from Venezuela, and six sympatric species from Costa Rica. Wing shapes of species from Venezuela all differ significantly; however, only two species differ significantly from other species from Costa Rica. This finding is curious because four of the six species in Costa Rica feed on a single species of host and have indistinguishable pigmentation patterns. Three of the four species from Venezuela feed on a single species of host; yet, all three differ from each other both in pigmentation pattern and shape. To explain this disparity in patterns, we examined our data in a phylogenetic context. We focus on sister clades (two closely related sets of species), each of which includes Venezuelan and Costa Rican species. Wing shape varies significantly in one clade, but not the other. We suggest that wing

displays that are synapomorphies of the sister clades may constrain divergence of wing shape in one clade, but not in the other.

135. THE EFFECT OF UV-B RADIATION ON THE PROLIFERATION OF EPIDERMAL CLUB CELLS IN ZEBRAFISH^{βββ}

Courtney Rud
Minnesota State University Moorhead, MN

Predator attacks release an alarm from ruptured club cells in the epidermis of minnows. This alarm cue warns members from the same species of the presence of a predator. The reason for possessing club cells is not clear because no benefit is directly given to the fish being preyed upon. We tested an alternate hypothesis, that epidermal club cells protect minnows against ultraviolet radiation, and their function as an alarm cue is secondary. We studied club cell response to UV-B radiation by exposing zebrafish (in the minnow family) to 330 microwatts per cm² for one hour each day over five days. We will count club cell density from histological preparations of epidermal tissue and compare it against control fish that were not exposed to UV-B. We predict that if club cells serve an anti-UV function, then zebrafish exposed to UV-B will have greater club cell density than zebrafish that were not exposed to UV. Our data will help resolve a long standing conundrum in evolutionary ecology by providing a mechanism by which individuals benefit directly from their own club cells.

136. NEW SPECIES OF TROPICAL FRUIT FLIES: EVIDENCE FROM BEHAVIOR AND MOLECULES^{βββ}

F. Serna, K. Flaherty and M. Condon
Cornell College, Mt. Vernon

Blepharoneura fruit flies reared from *Gurania spinulosa* (male and female flowers) exhibit distinctive courtship behaviors. We wanted to know if behavior could be used to distinguish species. We watched videotapes of flies, looked for overall behavior patterns, identified and named behaviors (e.g. "rock", "clap", "shiver"), and noted times of occurrence of each behavior for each specific fly. For phylogenetic analysis, we chose individual specimens that exhibited distinctive behaviors. We will subject behavioral data to phylogenetic analysis in PAUP. If our analysis generates a stable most parsimonious tree, we will use the phylogenetic species concept to recognize species. To test the strength of our results, we will analyze molecular data from the same sample of flies. To do so, we extracted DNA from our sample of flies, amplified and sequenced the mitochondrial cytochrome oxidase subunit I region. We will use PAUP to analyze the sequence data. If the tree(s) generated from molecular data conflicts with the tree(s) generated from behavioral data, we will reject our hypothesis.

137. PROTEIN PHOSPHORYLATION AND THE ASSEMBLY OF SEA URCHIN EGG MICROTUBULES

βββ

Samadhi Wijesinghe

Department of Biology, Minnesota State University
Moorhead, MN

Microtubules (MTs) are an important cytoskeletal element found in most eukaryotic cells. MTs form the mitotic spindle that rapidly and accurately segregates the replicated chromosomes to the opposite sides of the dividing cell. Biologists are intrigued as to how this process works. The study of this process is a critical area of cancer research. Cells that fail to segregate DNA into new cells will not divide. The identification of the mechanisms and targets that regulate microtubule assembly may provide us with new strategies for halting division in cancerous cells. Sea urchin eggs are an excellent model system in which to study spindle assembly. The regulation of microtubule assembly is controlled by the protein phosphorylation/dephosphorylation of Microtubule Associated Proteins (MAPs). These proteins bind to, copurify with and stabilize MTs. When MAPs become phosphorylated they lose their affinity for MTs, causing the MTs to shrink. Thus MAPs can modulate the assembly/disassembly of MTs. Previous work has identified 44kD and 48kD microtubule copurifying proteins as potential phosphorylation targets. The molecular weights of these proteins are suggestive of MAP Kinase (Mitogen Activated Protein) members. These family members play important roles in growth and mitogenic (potential cancer causing) pathways. Our goal is to determine how MAP Kinase regulates cell division and spindle assembly by monitoring MT assembly in the presence and absence of Okadaic Acid, a known phosphatase inhibitor. Okadaic Acid has previously been demonstrated to alter MT assembly. We are interested in identifying the MAPs that this phosphatase inhibitor may protect from dephosphorylation. Using this approach we hope to identify a cell signaling regulator of MT assembly.

138. ABIOTIC DIFFERENCES IN NEST SUBSTRATE THAT MAY DETERMINE REPRODUCTIVE SUCCESS AND PATTERNS OF CARE IN THE FATHEAD MINNOW (*PIMEPHALES PROMELAS*)^{βββ}

Shireen Alemadi¹, Tom Dye², Katie Geray², Jodi Hendrickson², Courtney Rud², Brian Wisenden²

¹Biology Department, University of Central Florida, Orlando, FL; ²Biology Department, ²Minnesota State University Moorhead, Moorhead, MN

Reproductive success ultimately shapes the way animals adapt to their environment. The environment comprises biotic (biological) and abiotic (non-biological) factors. Abiotic factors are measures such as temperature and dissolved oxygen that affect an animal's ability to survive and reproduce. Fathead

minnows are common fish in small lakes in Minnesota exhibiting male uniparental care. We studied their reproductive ecology in Itasca State Park and recorded the abiotic characteristics of two types of nests; those on the underside of lily pads and those on the underside of submerged sticks. We found that lily pad nests contained more eggs and with eggs distributed over a larger area. Lily pad nests were warmer, at least during the day, than nests under sticks. Dissolved oxygen levels were slightly higher under lily pads. Cooler temperatures and lower levels of dissolved oxygen could cause slower rates of egg development and higher rates of egg fanning for parental males. Taken together, the abiotic environment associated with these two nest types could determine patterns of reproductive behavior by male and female minnows.

ORAL PRESENTATIONS

139. ONLINE HERPETOLOGICAL ATLAS OF IOWA

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²Department of Biology, Drake University, Des Moines

Determining the distribution of organisms is a critical part of developing a plan for their conservation. Our knowledge of the distribution of amphibians and reptiles in Iowa is growing and there is no single source of information on their distribution in the state for the public or interested scientists. We have compiled over 10,000 species distribution records of various forms that have been put into a relational database for use with ArcView mapping software. This will allow us to not only examine the current distribution of the approximately 66 (27 snake, 5 lizard, 13 turtle, 16 frog, and 5 salamander) species of reptile and amphibian inhabiting Iowa but will also give us the tools to look at historical changes in distribution and patterns related to habitat types, geological landforms, or human density. We are completing a scholarly book where we will publish detailed distribution maps but in the interim county records of each species will be published on the internet. This webpage would continue into the future as a resource for the people of Iowa as distribution maps are obsolete soon after they are put into print. Hence, using a web site on the Internet is the best way to provide current distribution maps to the public. The maps will be dynamically updated as the database itself is updated. We will provide maps of records that we are confident in, and this should help support conservation efforts and identify natural areas of Iowa where resource managers can concentrate efforts to protect sensitive species.

140. POPULATION DECLINES IN ILLINOIS MUD TURTLES

James L. Christiansen

Department of Biology, Drake University, Des Moines

The Illinois Mud Turtle, *Kinosternon flavescens spooneri* has a disjunct distribution in Illinois, Missouri, and Eastern Iowa. The largest known population exists at Big Sand Mound in Louisa and Muscatine counties where the turtle has been studied for the last 30 years. Population estimates were made in 1978, 1988, and every three years since then. The turtle has declined in the primary sampling area every year since 1988 to an estimated 1/6 the 1988 estimate. While the estimates have a large margin of error, the decline in total captures and original captures of the species suggest that the change is meaningful. Recent data are unavailable for the Illinois and Missouri populations but the last studies made all suggest that they too are declining severely. Because this species is evolving away from the nominate subspecies, its extinction would eliminate a possible future species and would mark another reduction in the biodiversity of the Midwest.

A more extensive study is proposed for the Big Sand Mound population in 2006. This study will sample the turtle in areas that have undergone habitat restoration in the last eight years and a study in 2002 demonstrated that the abundance had improved in one of these areas. MidAmerican Energy and Monsanto Companies are commended for their effort to restore the native habitat. Similar studies and efforts are desperately needed in Missouri and Illinois.

141. CONSERVATION GENETICS OF BLUE-SPOTTED SALAMANDERS (*AMBYSTOMA LATERALE*)

Jonathan M. Eastman¹, Theresa A. Spradling¹, James W. Demastes¹ and Harlo Hadow²

¹Department of Biology, University of Northern Iowa, Cedar Falls; ²Department of Biology, Coe College, Cedar Rapids

Arguably, the primary intention of conservation genetics is to preserve allelic variability within and among populations; this, given that a lack of genetic diversity attenuates the viability of a population subjected to non-static environmental conditions. The influence of such evolutionary processes as genetic erosion and inbreeding depression are pronounced for increasingly small and isolated populations. Blue-spotted salamanders (*Ambystoma laterale*), though widespread and relatively common throughout northeastern North America, are marked by a pair of peripherally isolated populations in Iowa which are at the southwestern boundary of the range. These populations, seemingly, are relicts of post-glacial isolation and potentially provide a model from which to ascertain the extent and rapidity of evolutionary decay in similarly disjunct, amphibian

populations. We examined population genetics of relict populations (in Iowa) and compared them to a reference population in Minnesota that is in genetic contiguity with the greater extent of the species distribution. Time of divergence between populations, heterozygosity, effective population size, deviation from Hardy-Weinberg equilibrium expectation, and inbreeding coefficient, for each population were determined by assessing allelic variation of five nuclear microsatellite loci. Results indicate substantial inbreeding as well as a recent genetic bottleneck for one of the isolated Iowa populations; as such, this population may be subject to a heightened risk of extirpation. Tangentially, the present condition of blue-spotted salamanders may be indicative of the status of other amphibian and reptilian species in the same geographic localities, these biota being comparably susceptible to environmental or genetic perturbations.

142. PHYLOGEOGRAPHY OF THE BLUE-SPOTTED SALAMANDER (*AMBYSTOMA LATERALE*)

James W. Demastes, Jonathan M. Eastman and Jade S. East

Department of Biology, University of Northern Iowa, Cedar Falls

The blue-spotted salamander (*Ambystoma laterale*) has the northern-most distribution of any North American salamander and primarily occurs in areas that were once covered by the southern Laurentide Ice Sheet during the last glacial maximum. Mitochondrial DNA sequence data reveal geographic structuring with a well-supported clade located in the western portion of the range. Genetic variation at a single nuclear DNA microsatellite locus supports this finding which suggests the possibility of multiple Pleistocene refugia for this species (east and west). Furthermore, an analysis of migration patterns using 5 variable microsatellite loci indicate a north to south migration pattern among populations in the western clade, suggesting the presence of either a northern refugium in the west or colonization from an eastern refugium by way of the northern shore of the Great Lakes.

143. BEHAVIOR OF A BIZARRE SALAMANDER, THE LESSER SIREN (*SIREN INTERMEDIA*)

Allison A. Cherry, Shawna L. Baker and Jeffrey R. Parmelee

Department of Biology, Simpson College, Indianola

Virtually nothing is known of the reproductive behavior of the entire salamander family Sirenidae. In particular, we hope to determine the mode of fertilization utilized in the salamander species, the Lesser Siren (*Siren intermedia*). Previous studies have failed to determine this, with evidence supporting both internal and external fertilization. Clutches of eggs have also been described as being laid singly or in small clusters, to being laid in a mass of hundreds, with an attending female. These

contradictory observations and the opportunity to obtain these animals just before the breeding season has led us to begin a research project to solve a great mystery in amphibian biology. Bite marks and vocalizations also suggest interesting social behaviors. We have constructed aquaria in attempts to capture on tape the never before recorded social and mating behavior of *Siren intermedia*. Two aquaria have an "ant farm" set up so that we can observe their behavior under the substrate. Other aquaria have vegetation and clear plastic tubing to simulate burrows. These aquaria are under constant low-light video surveillance to capture their nocturnal behaviors. The combination of nocturnal video recording and unique artificial habitats should allow us to document the social behaviors of this enigmatic salamander species.

144. MORPHOLOGY AND DISCOVERY OF NEW SPECIES: BIOLOGICAL AND PHILOSOPHICAL ISSUES ^{βββ}

M. Nolte¹, A. Norrbom² and M. Condon¹
¹Cornell College, Mt Vernon; ²Systematic Entomology Laboratory, USDA-National Museum of Natural History

Most named species on Earth are "morphological species". Morphological species are names that refer to a set of organisms that are morphologically indistinguishable. With the advent of evolutionary theory, people have invented various "species concepts" that set forth rules for naming species. Species concepts, like the lineages to which many of the concepts refer, evolve. And like lineages, species concepts can be classified. There is a taxonomy of species concepts. Confusion, therefore, arises when scientists use the word "species" without specifying concepts, and when groups of organisms are classified according to different rules. I recently spent one month at the Smithsonian Institution's Museum of Natural History and participated in an effort to describe 40 newly discovered species of tropical fruit fly. In the process, I discovered that the procedures for finding and describing characters of morphological species are far less precise than I had anticipated. I report on my findings and their implications for understanding how species are named.

145. MORPHOMETRIC ANALYSIS OF LYTECHINUS VARIEGATUS, SEA URCHIN EMBRYOS. ^{βββ}

J. W. Brittingham, T. Beenken and A. Keller
Simpson College, Indianola

Sea urchins (*Lytechinus variegatus*) have many features that make them an important model system for studying development. Sea urchins are deuterostome organisms that demonstrate regulative development, where each cell produced by early cleavage retains the capacity to develop into a complete embryo. Blastomere separation at the two cell stage has been used as a successful method for producing monozygotic twinning in numerous species. This study was designed to investigate the

consequences of producing twins by this process. The differences in growth and development among normally developing sea urchin embryos and those separated at the two-cell stage were studied. Embryos were passed through a fine mesh sieve that mechanically dissociated two cell-stage embryos into single cells. Morphometric analysis was performed on images of separated blastomere-derived embryos and control embryos that had developed to the pleutus larval stages. Embryo perimeter and crown-to-opposite appendage lengths were measured. Analysis showed that the separated blastomere-derived embryos had a smaller perimeter and a reduction of the crown-to-opposite-appendage length. Removing a single blastomere from a two-celled embryo does not appear to affect the overall developmental capacity of the embryo. However, this quantitative analysis demonstrates that separated blastomere-derived embryos are significantly reduced in size, implying an incomplete mechanism to compensate for loss of embryonic material at even the earliest stages of development.

146. CRAB COMMENSALS IN TUBES OF THE POLYCHAETE WORM CHAETOPTERUS SP., THE BRACHYURAN PINNIXA CHAETOPTERANA AND THE ANOMURAN POLYONYX GIBBESI

Sandford, F.R.
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Each January over a 7-year period (1999-2005) U-shaped parchment tubes of the polychaete *CHAETOPTERUS* sp. were excavated at low tide from a N-facing bay on Dog Island, Florida, in the N. Gulf of Mexico. Tubes were dissected and examined for the presence of two common crab commensals, the brachyuran pea crab *PINNIXA CHAETOPTERANA* and the porcellanid *POLYONYX GIBBESI*, an anomuran. Of 114 tubes examined, 4 (3.5 %) had no crabs, 77 (67.5 %) had *PINNIXA*-only, 23 (20 %) had *POLYONYX* -only, and 10 (9 %) contained both species. For *PINNIXA*-only tubes, 90% contained a mixed-sex pair; for *POLYONYX*-only tubes, 57% contained a mixed-sex pair and the remainder contained a single crab. All tubes containing both species had either one or two adult *PINNIXA* and a small *POLYONYX* (cw < 3.5 mm). No tubes contained adults of both species. Among adult females, 24% of the *PINNIXA* and 44% of the *POLYONYX* were ovigerous. The *POLYONYX*-*PINNIXA* ratio of 20:80 showed a greater relative abundance of *PINNIXA* compared to reports from elsewhere along the W. Atlantic coast or the Gulf of Mexico. Experiments introducing single adult intruder crabs of either species into in situ tubes showed that adult crabs of either species evict same-sex conspecifics or heterospecifics; with time most tubes have a mixed-sex pair of only one of the two species.

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Symposium Abstracts (by order of program)

A. ECOLOGY OF OVERLOOKED LANDSCAPES

IMPORTANCE OF SAND PRAIRIES TO ORNATE BOX TURTLES IN IOWA

Neil P. Bernstein¹, Rebecca Richtsmeier¹, Robert W. Black² and Andrew Bausch²

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We have studied Ornate Box Turtles with our students since 1998 in a wildlife area in Johnson County. In the study areas, sand prairies are central to the yearly activities of the turtles, and the surrounding habitats have developed largely on sandy soils. We first summarize the turtles' relationship to sand prairies during winter, spring, summer, and autumn. We also summarize our recent analysis of correlations between individual turtles, sex, month and habitats in which we found them. Finally, we identify several threats to ornate box turtle survival with regards to habitat changes and other impacts surrounding our sand prairie study area.

AUTUMN RAPTOR MIGRATION THROUGH FEATURELESS COUNTRY.

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The Macbride Raptor Migration Research Station was established in 1992 and operated through 2003. Located in rural Johnson County, Iowa near the Macbride Nature and Recreation Area, the MRMRS is far removed from the geographical features ("lead lines" such as coastlines, mountain ranges and major river systems) that produce high concentrations of migrating raptors in other areas. In this report we summarize 12 years of observation on autumn raptor migration and compare our findings to those obtained along major lead lines in North America. In general, the migration rates observed at this featureless site are dramatically lower than those documented at lead line sites, but other aspects of migration are similar to those observed at lead line sites.

THE ECOLOGY AND NATURAL HISTORY OF PASTURELAND

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Pastureland comprises a significant amount of the landscape in some sections of Iowa. Whether it is grazed or abandoned, the grassland and savanna physiognomy provided supports many plant and animal populations native to Iowa's prairie communities. In some instances, animal species may fare just as well or even better than on native prairie remnants. Many factors, most of which are related to management history, influence the ecological value of pastureland. This paper will review the body of ecological research that has been conducted on Midwestern pastureland and demonstrate its ecological importance. Work on a variety of taxa will be summarized in order to answer the question -- how is pastureland important to the conservation of Iowa's flora and fauna?

B. PAST, PRESENT, AND FUTURE INVESTIGATIONS ON WATER-QUALITY ISSUES IN IOWA

PHARMACEUTICALS AND OTHER EMERGING CONTAMINANTS IN US WATER RESOURCES

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Since 1998, the U.S. Geological Survey (USGS) has been developing analytical capabilities to measure pharmaceuticals and other organic wastewater contaminants (OWCs) in a variety of environmental matrices. Currently, the USGS can analyze more than 140 OWCs using a variety of LC/MS and GC/MS techniques. To date, over 500 samples from across the United States, representing a wide range of climatic and hydrologic conditions, have been analyzed for OWCs. Early research focused on broad-scale reconnaissance studies, providing the first nationwide data on the occurrence of OWCs in water resources of the United States. These results documented that OWCs are commonly present in streams and, to a lesser extent, aquifers, particularly at sites that are immediately downstream or down gradient of contaminant sources. Some of the most frequently detected compounds included cholesterol (plant and animal steroid), DEET (insect repellent), caffeine (stimulant), triclosan (antimicrobial disinfectant), and tri(2-chloroethyl)phosphate (fire retardant). Prescription pharmaceuticals and antibiotics also have been commonly detected at ng/L concentrations. Detection of multiple OWCs was common, with as many as 38 OWCs being found in a single water sample. These results indicate that synergistic or additive effects from mixtures of OWCs will need to be evaluated. Subsequent research has focused on sources of OWCs and their fate and transport through the environment. Samples from municipal wastewater treatment plants and animal waste storage lagoons indicate that both human and animal waste can be sources of OWCs to the environment. Early results indicate that concentrations of OWCs generally increase as the percent of streamflow derived from municipal discharges increases. Recent research has shown that bed sediment can also act as a reservoir of pharmaceuticals and other OWCs to the environment.

TIME OF TRAVEL, LAGRANGIAN SAMPLING, AND WATER-QUALITY: STUDIES FROM FOURMILE CREEK AND THE CEDAR RIVER, IOWA.

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Abstract unavailable.

THE BIG SPRING BASIN AT TWENTY

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The agricultural practices, hydrology, and water quality of the 267 km² Big Spring groundwater basin in NE Iowa were the subject of comprehensive studies from 1982 to 2002. Land use is dominated by corn and alfalfa production, with numerous small livestock operations; nitrate-N and herbicides are the resulting contaminants in ground- and surface water. The karsted Galena Group carbonates are the main aquifer in the basin, which is recharged dominantly by infiltration, augmented by sinkhole-captured runoff. Groundwater is discharged to the surface at Big Spring, where the quantity and quality of the discharge is monitored. Monitoring has shown a three-fold increase in groundwater nitrate-N concentrations from the 1960's to the early 1980's, paralleling increases in nitrogen fertilizer applications. The nitrate-N discharged from the basin by ground- and surface water typically is equivalent to over one-third of the nitrogen fertilizer applied, with larger losses and greater concentrations occurring during wetter years. Atrazine is present in the groundwater year round. Education and demonstration efforts have decreased pesticide use and have reduced nitrogen fertilizer application rates by one-third since 1981, while crop yields have been maintained. Relating the declines in nitrogen and pesticide inputs to nitrate and pesticide concentrations is confounded by year-to-year variability in recharge, which strongly affects concentrations.

A PRESENTATION BY MARK SKOPEC.

Mark Skopec
Iowa Geological Survey, Iowa City

Abstract unavailable.

C. GEOLOGIC CONTRIBUTIONS TO ARCHAEOLOGICAL METHOD AND THEORY

DEFINING A PALEOINDIAN DISTRICT ON THE EASTERN PLAINS – OZARK BOUNDARY IN SOUTHWEST MISSOURI.

E.R. Hajic

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Results of a cutbank survey of the lower Sac River valley in southwest Missouri are combined with an integrated geomorphic, stratigraphic, radiocarbon and GIS analysis to pinpoint the context and location for discovery of Paleoindian cultural deposits. The lower Sac River valley, location of the Big Eddy and Montgomery stratified, multicomponent, Paleoindian sites, has yielded a large number and variety of Paleoindian points from active cutbanks over the last 30 years. Floodplain overbank deposits of the early submember of the Rodgers Shelter member, the oldest unit beneath a low terrace, hosts a vast array of temporally diagnostic Paleoindian projectile points. The low terrace comprises about a third of the valley area. Half of the cutbanks in the lower valley cut into this sediment assemblage, and well over half of these expose Paleoindian components, with more than one component exposed at four locations. When the yield in Paleoindian projectile points is adjusted to per unit volume of eroded early submember, it is clear that one of the richest, best preserved, Paleoindian districts in the country resides in the lower Sac River valley.

STABLE ISOTOPE GEOCHEMISTRY: AN IMPORTANT TOOL IN THE KIT FOR ARCHAEOLOGICAL AND PALEOANTHROPOLOGICAL RESEARCH.

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Stable isotopes of carbon and oxygen are selectively incorporated into the tissue, bone, and shell of living organisms and some inorganic components of soils. The degree of uptake of different isotopes of a given element can be used to shed light on a range of topics central to interpretation of the record of the human past. Examples from the Holocene of Iowa and the early Pleistocene of Indonesia demonstrate how stable isotope studies of soil organic carbon and carbon and oxygen in soil carbonates provide information on the composition of past vegetation communities and soil water conditions, and allow us to track environmental changes through time. Carbon and oxygen isotope studies of freshwater shells can yield a detailed picture of seasonal to decadal conditions of the water bodies in which the organisms lived. Combined, these sets of data can provide archaeologists and paleoanthropologists with environmental information to address human adaptations at the scale of lifetimes and human evolution.

BLACK DIRT AND GRAY LITERATURE: CREATING A HOLOCENE STRATIGRAPHY DATABASE FROM GEOARCHAEOLOGICAL REPORTS

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The Landscape Model for Archaeological Site Suitability (LANDMASS), currently under development, is a research and decision-support tool for studying and predicting prehistoric site locations in Iowa. Part of the LANDMASS project entails compiling a digital library of core, outcrop, and profile descriptions from Iowa's Holocene alluvium. Core locations are digitized in ArcView and linked to a database containing the cores' details such as lithostratigraphic unit, soil horizonation, color, texture, bedding, effervescence, solum thickness, Bt horizon thickness, and radiocarbon ages. Standardization and linked tables are a key to keeping the database from becoming unwieldy. The GIS and database is a compilation of core descriptions from over 208 publications and reports dating from the 1970's to present. The database presently contains 3,842 cores subdivided into 5,945 lithostratigraphically-correlated depositional units which are further divided into 19,344 strata that represent soil horizons and/or sedimentary beds with each horizon containing information formerly listed. Lithofacies codes assigned to each stratum identify transport energy regimes that in turn reflect prehistoric habitability and archaeological preservation potential. The database will be a useful decision-support tool for archaeological survey planning, as well as a research tool for studying local and regional trends in valley alluviation.

BETTER ARCHAEOLOGY THROUGH GEOLOGY; CURRENT STATUS AND FUTURE DIRECTIONS OF THE UI-OSA LITHIC RAW MATERIAL ASSEMBLAGE.

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Office of the State Archaeologist, Iowa City

Most Iowa archaeological assemblages are dominated by lithic materials. Geologic identification of these lithic materials and their source location is one of the few ways of making cultural inferences regarding prehistoric use. The UI-OSA lithic raw material assemblage encompasses over 250 in-state samples reorganized to align with the geologic column of Iowa, represent geo-physical regions, and to afford a more systematic and consistent geologic approach to macroscopic lithic identification. This data is available through a UI-OSA web-based lithic resource page. Lastly, this paper summarizes analytical tools, in addition to the existing macroscopic identification key, that may be applied to the assemblage for improved future use.

A PETROGRAPHIC STUDY OF SHOSHONEAN POTTERY FROM THE EASTERN SNAKE RIVER PLAIN, IDAHO

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Shoshonean pottery sherds representing about 35 pots were collected from four different localities on, or marginal to, the eastern Snake River Plain in southeastern Idaho. The typology of lithic artifacts found in close spatial proximity to most sherds suggests that the pots were made during the past few hundred years. By means of pottery reconstruction, the sizes and shapes of the majority of pots have been defined. The vessels fall into two broad categories: 1) unrestricted orifice (flower pots and bowls) and restricted orifice (jars). Surface-parallel and surface-transverse thin sections were made and studied with the petrographic microscope to determine the physical and mineralogical characteristics of non-plastic inclusions (temper). Inclusions in most pots are heterolithic and all consist of crushed rock, with little or no detrital quartz. Crushed-rock compositions of pots from the Fort Hall area indicate that material was obtained from local outcrops and/or from nearby Snake River gravels. Crushed-rock compositions of pots from the Lake Channel area also suggest a local Snake River source. These data indicate that pottery was manufactured near the sites where the sherds were collected.

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