109th Annual Meeting
The Ohio Academy of Science
Hosted by
Ohio Northern University
Ada, Ohio
March 31; April 1-2, 2000

About the Annual Meeting

THE OHIO ACADEMY OF SCIENCE'S ANNUAL MEETING is for academic, governmental, and industry scientists and engineers, university and pre-college educators and teachers, and pre-college, undergraduate, and graduate students, and interested lay citizens in the Ohio region. Annually the several hundred scientific presentations are complimented by workshops, symposia, an All-Academy Lecture, and field trips on local geology and plant sciences.

Welcome!

Ohio Northern University welcomes you to the 109th Annual Meeting of The Ohio Academy of Science. We invite you to explore our campus and to share in the excitement and opportunities provided in this program.

REGISTRATION: Registration is required for all meeting presenters and attendees. On-site registration will be available at a higher rate. To assure reservations for meals, forms must be received by The Ohio Academy of Science by **March 22, 2000.** Please use Registration Form the on last page. Mail completed forms and fees to:

OAS Annual Meeting Registration
The Ohio Academy of Science
PO Box 12519
Columbus OH 43212-0519
FAX 614/488-2228 (for Credit Card or PO only)

Registration by credit card or purchase order only will be accepted by FAX at 614/488-2228. Your packet, receipt, and name tag will be ready at the meeting registration desk upon your arrival. For further information, please call 614/488-2228.

Friday, March 3: Registration will be held in Meyer Hall Atrium from 12:00 Noon to 2:00PM. On-site registration is possible by check, VISA, or Mastercard. Cash is discouraged.

Saturday, April 1: Registration will be held in Meyer Hall Atrium from 8:00AM-3:00PM. On-site registration is possible by check, VISA, or Mastercard. Cash is discouraged.

Special Acknowledgments: The Ohio Academy of Science expresses its appreciation to METCALF & EDDY for financial support of the Saturday, April 1 Environmental Sciences Breakfast. We also thank the OHIO NORTHERN UNIVERSITY CHAPTER OF SIGMA XI for partial support of the afternoon reception on Saturday, April 1st.

Local Arrangements: DR. TERRY KEISER

PARKING: Free parking is available in lots near Meyer Hall on the north edge of campus.

SMOKING POLICY: Smoking is not permitted in any building on campus.

MEALS: **Friday, March 31.** Preregistration required by March 22 for the Ohio Academy of Science Annual Meeting Banquet held jointly with The Ohio Biological Survey. **Saturday, April 1.** Lunch will be available in MacIntosh Hall. See registration form. There is no Saturday evening meal.

HOUSING: Please contact hotels and motels directly. See list on page A-5. HOUSING IS NOT AVAILABLE IN ADA.

GENERAL SCHEDULE

Friday, March 31, 2000

10:00 AM **The Ohio Academy of Science Board of Trustees Meeting**
Meyer Hall Room 118

12:00 Noon **Lunch on own in MacIntosh Center**

1:30 PM ***The Nature of Science: MICROBIAL DISCOVERY WORKSHOP***
Arranged by ROD ANDERSON, PH.D.
Meyer Hall Room 104

Welcome-Introductions
Workshop Overview and Objectives
Sizing Up the Microbial World
Introduction to the Invisible World—
30X Microviewer Exercises
2:15 Biofilms and Microdiscovery Boards

3:15 Break

3:30-5:00 Biodegradation Columns and
Can Microbes Taste the Difference?

Target Audience: Junior and Senior High Science Educators

Objectives: The purpose of the workshop is to have teachers complete several hands-on inquiry-based labs that will enable them to present a balanced view of the life sciences by using microorganisms to teach concepts and principles found in the National Science Standards. The exercises will focus on the positive roles that microorganisms play in our lives and use low cost, easily found equipment and materials.

Personnel: Dr. Anderson is a Professor of Biological Sciences at Ohio Northern University and has lead and coordinated Microbial Discovery Workshops in Ohio, Florida, Idaho, Wisconsin and Texas. He is a member of the Precollege Education Committee of the American Society of Microbiology. Spencer Reames, a faculty member at Benjamin Logan High School, has been on the workshop faculty at national Microbial Discovery Workshops and has conducted numerous workshops.

Activities: The activities of the Microbial Discovery Workshop have been developed by secondary teachers and the Precollege

Committee in association with the American Society of Microbiology and the National Association of Biology Teachers. They have been welcomed for their simplicity and their adaptability to numerous instructional levels. All activities are hands-on investigative activities that meet *National Science Education Standards.*

Materials: Each participant will receive the *Power Unseen: How Microbes Rule the World*, by Bernard Dixon, *A Microbial Discovery Workshop Manual* containing the activities completed during the workshop; *Bottle Biology*; and *Meet the Microbes*, a set of investigative labs developed by the Microbial Literacy Collaborative. Materials for the workshop are supplied by a grant from the American Society for Microbiology.

2:00-5:00 PM **Ohio Biological Survey**
Executive Committee
Meyer Hall Room 118

6:00 PM **Joint OAS-Ohio Biological Survey Dinner** - MacIntosh Center

Special Address
THOMAS RUMER, Author
UNEARTHING THE LAND: The Story of Ohio's Scioto Marsh

THOMAS A. RUMER, a native of Kenton, Ohio, is a freelance writer and public historian for the Carmel Clay Historical Association. He received his BS and MA degrees in history and English from Ball State University and his MLS from Indiana University. He has published five books, including *This Emigrating Company: The 1844 Oregon Trail Journal of Jacob Hunter* and *The American Legion: An Official History.* His work has also appeared in *Indianapolis Monthly* and *Indiana Magazine of History.*

Saturday, April 1, 2000

7:30 AM **Special Environmental Sciences Breakfast**
(by invitation only; must be pre-registered)
Hosted by METCALF & EDDY
MacIntosh Center
Special Report: How to Apply to the Academy for Ohio Environmental Science and Environmental Engineering Undergraduate Scholarships

8:00AM-3:00PM **General Meeting Registration**
Meyer Hall Atrium

9:00-11:00AM ***The Nature of Science: TEACHING SCIENCE PROCESS SKILLS***
Arranged by RUTH M. WILLEY
Fremont Ross HS, Fremont OH
Meyer Hall Room 104

Science Process skills are the things scientists do when they do science. These skills, by themselves, can generate science content and concepts and are the critical aspects of any science class, K-12. In many state proficiency tests, these skills are the areas where our science students are failing, mostly because science classes have become textbook-based. This presentation will use activities to help teachers focus on and include those beginning aspects of true science: observation, inference, classification, prediction. The activities will then address higher level aspects of controlled scientific investigations: identifying variables, correct data table and graphing procedures, describing relationships between variables. Teachers will perform activities and be provided with resources to use in their classroom.

9:00-11:00AM **Morning poster and podium presentations.**

11:15AM **All Academy Lecture**
The Nature of Science: EVOLUTION
EUGENIE C. SCOTT, Ph.D.
Meyer Hall Room 107

Since 1987 EUGENIE C. SCOTT has been the Executive Director of the National Center for Science Education, Inc., a pro-evolution nonprofit science education organization with members in every state. She holds a Ph.D. in biological anthropology from the University of Missouri. Scott has taught at the University of Kentucky, the University of Colorado, and in the California State University system. A human biologist, her research has been in medical anthropology and skeletal biology. She has many published papers and monographs, has served as chair of the Ethics Committee of the American Anthropological Association, and served as the Secretary-Treasurer of the American Association of Physical Anthropologists. In 1994, Scott was elected to the California Academy of Sciences.

She is nationally-recognized as a proponent of church/state separation, and serves on the National Advisory Council of Americans United for Separation of Church and State, on the National Advisory Council of Americans for Religious Liberty, and has served on the Executive Committee of the National Coalition for Public Education and Religious Liberty (PEARL). Scott has also served on the Board of Directors of the Biological Sciences Curriculum Study. An internationally-recognized expert on the creation/evolution controversy, she has consulted with the National Academy of Sciences, several State Departments of Education, and legal staffs in both the United States and Australia.

Scott has worked nation-wide to communicate the scientific method to the general public and to improve how science as a way of knowing is taught in school. She is frequently called upon by the print, radio, and television media as a spokesperson for "the scientific view" when conflicts arise between scientific and pseudoscientific explanations, including appearances on *Donahue, Geraldo, Crossfire, Firing Line, Ancient Mysteries, CNN, Morning Edition, The Pat Buchannan Show, Science Friday,* and *All Things Considered.* She was featured in the Nova program "In the Beginning: The Creationist Controversy." Scott is listed in *Who's Who in Science and Engineering*, and has been made a FELLOW of the Committee for the Scientific Investigation of Claims of the Paranormal, from which in 1991 she received the Public Education in Science Award. In 1993 she was selected a University of Missouri Arts and Sciences

College Distinguished Alumnus, and in 1998, received the Isaac Asimov Science Award from the American Humanist Association. In 1999 she received the Skeptics Society James Randi Award, the Hugh H. Hefner First Amendment Award, and the American Society of Cell Biology's Bruce Alberts Award. She is a co-author of the National Academy of Science's *Teaching About Evolution and the Nature of Science*, and has consulted with the NAS on the revision of its *Science and Creationism* booklet.

Scott has been both a researcher and an activist in the creationism-evolution controversy for several years, and can speak to problems created by this sectarian challenge to science education from many directions: educational, legal, scientific, and/or social. A dynamic speaker, she offers stimulating and thought-provoking as well as entertaining lectures and workshops.

National Center for Science Education,
925 Kearney St., El Cerrito, CA 94530-2810
Phone: 510-526-1674 or 1-800-290-6006
email: scott@natcenscied.org • http://www.natcenscied.org

12:00 NOON **Special Recognition Ceremony**
of newly elected FELLOWS of
The Ohio Academy of Science

12:15PM **Lunch available in MacIntosh Center**

12:15 PM **Luncheon Discussion** (optional)
Learn About the Ohio Campus Compact
Arranged by Michael Barker, Director,
Ohio Academy of Science
Student Advisory Council

You may select your lunch and come to the breakout room in the MacIntosh Center

THE OHIO CAMPUS COMPACT (OCC) is a membership organization of Ohio colleges and universities established to support the development of campus-wide student and institutional participation in community and public service. OCC is part of the national Campus Compact, a coalition of over 520 college and university presidents established to create public service opportunities for their students and develop an expectation of service as an integral part of the undergraduateexperience.

OCC (1) seeks to integrate service into faculty instruction and students' studies, making community service activities a valued element of the undergraduate experience; is (2) committed to enhancing students' responsibility, citizenship and awareness of the community while reinvigorating higher education's concern for improving the quality of life in society; (3) is committed to strengthening the impact of that service on the welfare of communities and the education of students in institutions of higher education. For more information contact: Ohio Campus Compact, 615 North Pearl Street, Granville, OH 43023. Phone: 740/587-7680; FAX: 740/587-7681; Richard Kinsley, Executive Director, occdick@alink.com Website: http://www.ohiok-16service.org/occabout.htm

1:30-5:00PM **Afternoon poster and podium presentations**

2:00-3:30PM **Workshop: Writing Theses and Dissertations**
Arranged by ISADORE NEWMAN, PH.D.
AND DONNA WAECHTER, PH.D.
Meyer Hall Room 104

Objectives: 1. Help students get started by introducing them to the structure and components of theses and dissertations. 2. Help faculty who are supervising dissertations or theses to facilitate students in their writing. 3. Give examples of how to get students started and increase the likelihood of students being able to finish.

Presenters: ISADORE NEWMAN, Ph.D. has been on over 300 dissertation committees in many disciplines. He has also written a book entitled: *Thesis and Dissertations in the Physical and Social Sciences*. DONNA WAECHTER, Ph.D. has taught techniques of research, testing and measurement with an emphasis on papers and writing for seven years.

5:15PM **OFFICIAL NOTICE**
of Annual Business Meeting
for Academy Members Only
Meyer Hall Rm 104
See page 44

Sunday, April 2, 2000

7:45AM **Plant Science Field Trip: LAWRENCE WOODS STATE NATURE PRESERVE**
Arranged by MARSHAL MOSER
and NELSON MOORE

Lawrence Woods is a 1100 acre State nature preserve located 5 ½ miles south of Kenton, Hardin County, Ohio. It is one of the most recent purchases by the Division of Natural Areas and Preserves of the Ohio Department of Natural Resources. The preserve was officially dedicated on May 1, 1999, with Gov. Taft as the main speaker. The area features a 400-acre mature wet hardwood forest, tilled agricultural land and more than 50 acres of farmland in succession. A number of uncommon and state-listed species have been found including the four-toed salamander, heart-leaf plantain, pumpkin ash and swamp cottonwood. Many aspects of the area can be viewed from a 1½ mile boardwalk which circles through the woods, including a large buttonbush swamp. Meet at the parking lot on the north side of Meyer Hall of the Ohio Northern University at 7:45AM. The field trip will run between 8:00AM - 12 NOON. The field trip will be lead by Marshal Moser and Nelson Moore, both of whom were instrumental in drawing the attention of the State to this unique habitat as an outstanding example of northwest Ohio's original forest.

8:30AM **Geology Field Trip: LOWER SILURIAN (LLANDOVERY-WENLOCK) STRATIGRAPHY OF WEST-CENTRAL OHIO**

Arranged by: MARK A. KLEFFNER, The Ohio State University at Lima

Meet at the new Science Building on The Ohio State University at Lima campus for coffee, tea, soft drinks, and donuts. The Ohio State University at Lima campus is just a 15-minute drive west of Ohio Northern University, on State Route 309 (Harding Highway). Field trip participants may park in the south parking lot (first turn to right after turning off of SR 309. Enter Science Building through main entrance on south side. Participants may tour the museum and other facilities of the Department of Geological Sciences while eating and drinking. We will leave the south parking lot in private cars around 9:00AM. We will first travel to a locality near West Milton, Ohio, to examine the Llandovery Brassfield Formation (and perhaps some of the subjacent Ordovician and suprajacent Dayton Formation). We will then continue south to a location just north of Yellow Springs for lunch. This location is Young's Dairy Barn, which is known statewide for excellent ice cream and baked goods. If you choose not to buy your lunch there, they do have picnic tables available to use if you bring your lunch or buy it elsewhere. After lunch, we will complete the field trip by traveling a few miles to the east, to John Bryan State Park, where we will examine the remainder of the Lower Silurian exposed in west-central Ohio, including the upper part of the Brassfield, Dayton, Osgood, and Laurel Formations (including Massie Member), and Euphemia, Springfield, and lower part of Cedarville Dolomites.

Our Host

Ohio Northern University, a United Methodist-related institution of higher learning, seeks to educate and graduate students accomplished in scholastic achievement, prepared for a useful life and meaningful career, inspired with a desire to contribute to the good of mankind consistent with Judeo-Christian ideals and committed to a quality of life that will result in maximum personal and social worth.

Ohio Northern's purpose is to help students develop into self-reliant, mature men and women capable of clear and logical thinking and sensitive to the higher values of truth, beauty and goodness. In keeping with this goal, students will be exposed to diverse ideas and influences, including those of professional programs, which broaden and strengthen the college experience and help to prepare them for later life.

The campus is located in northwest Ohio and is easily accessible from major highways. ONU is only 90 minutes by car from Columbus, Toledo, Dayton, and Fort Wayne. Travel is also easy from Cincinnati, Cleveland, Pittsburgh, Chicago, Indianapolis, and other large cities. Commercial air service is available in Toledo, Columbus, and Dayton.

As a community, Ada provides an ideal setting for the ONU campus. The relaxed, comfortable atmosphere of the rural community of about 5,000 is oriented to studying and learning. The friendly community offers a good selection of shops, stores, and restaurants.

Ada's rural setting is complemented by major shopping districts and diverse industries and businesses in the city of Lima, only 15 miles west of campus. After the short drive to Lima, students find a variety of restaurants, movie theatres, major shopping malls, and other attractions. DR. TERRY KEISER, Chair of Biological Sciences, will serve as chair of local arrangements.

HOUSING

LIMA AREA

Comfort Inn
1210 Neubrecht Rd
Lima, OH 45801-3118
(419)228-4251

Days Inn
1250 Neubrecht Rd
Lima, OH 45801-3118
(419)227-6515

Econo Lodge
1201 Neubrecht Rd
Lima, OH 45801-3117
(419)222-0596

Fairfield Inn
2179 Elida Rd
Lima, OH 45805-1518
(419)224-8496

Hampton Inn
1933 Roschman Ave
Lima, OH 45804-3496
(419)225-8300

Holiday Inn
1920 Roschman Ave
Lima, OH 45804-3444
(419)222-0004

Knights Inn
2285 N Eastown Rd
Lima, OH 45807
(419)331-9215

Motel 6
1910 Roschmand Ave
I-75 and State Route 309
Lima, OH 45804
(419)228-0456

Ramada Inn
3600 E Bluelick Rd
I-75 and Bluelick Rd
Lima, OH 45801
(419)221-0114

Super 8
1430 Bellefontaine Ave
I-75 and State Route 309
Lima, OH 45804
(419)227-2221

Wingate Inn
150 W Market St
Lima OH 45801
(419)222-6075

KENTON AREA

AmeriHost Inn
902 East Columbus Street
Kenton, OH 43326
(419) 675-1400

Doctor's Inn Bed and Breakfast
346 North Detroit Kenton
Kenton, OH 43326
(419) 673-0419

FINDLAY AREA

County Health Inn
1020 Interstate Ct
Findlay OH 45840
(419)423-4303

Cross Country Inn
1951 Broad Ave
Findlay OH 45840
(419)424-0466

Days Inn
1305 W Main Cross St
Findlay, OH 45840
(419)423-7171

Econo Lodge
316 Emma St
Findlay, OH 45840
(419)422-0154

Fairfield Inn
2000 Tiffin Ave
Findlay OH 45840
(419)424-9940

Findlay Inn & Conference Center
200 E Main Cross St
Findlay, OH 45840
(419)422-5682

Knights Inn
1901 Broad Ave
Findlay, OH 45840
(419)424-1133

Hampton Inn
921 Interstate Dr
Findlay OH 45840
(419)422-5252

Holiday Inn Express
941 Interstate Dr
Findlay OH 45840
(419)420-1776

Holiday Motel
428 Lima Ave
Findlay OH 45840
(419)423-0575

Ramada Inn
820 Trenton Ave
Findlay OH 45840
(419)423-8212

Super 8 Motel
1600 Fox St
Findlay, OH 45840
(419)422-8863

Index to Poster and Podium Sessions
Saturday, April 1, 2000

NOTE: Undergraduate Research-in-Progress Reports, as opposed to abstracts, are designated by having names of student advisor(s) in (parentheses) following the name(s) of students. Pre-college students have included the names of their schools in (parentheses)

Poster Session
Biological; Earth & Space; Environmental Sciences
9:00-10:00 AM
Meyer Hall

Board 01 EXPERIMENTAL TEST OF A HYPOTHESIS THAT ZEBRA MUSSELS (*DREISSENA POLYMORPHA*) ALTER PHYTOPLANKTON P-DYNAMICS BY RELEASE OF PHOSPHATE. Jennifer E. Cline and R. T. Heath. Kent State University, Dept of Biological Sciences, Kent, OH 44242. Jecline7@aol.com

Growth and activity of phytoplankton are usually limited by the amount of phosphorus available. The phosphorus availability can influence total phytoplankton growth as well as the species of phytoplankton present. Current management strategies have sought to limit phytoplankton growth by decreasing the amount of phosphate input to water bodies. Past research has demonstrated that zebra mussels alter the phosphorus dynamics by remineralizing large quantities of particulate phosphorus and releasing the phosphorus in a soluble form readily available to phytoplankton, thereby releasing the phytoplankton from phosphorus limitation. During the summer of 1999, another study was conducted to experimentally attempt to mimic the effects of zebra mussels on communities not affected by zebra mussels. Experimental additions of phosphate in quantities similar to that of the zebra mussels were added to nutrient amendment bottles containing water from East Twin Lake, a mesotrophic glacial kettle lake near Kent, Ohio. We found that additions of phosphate similar to those provided by zebra mussels did not alter physiological and community factors of phosphorus dynamics to the same extent as the addition of a zebra mussel community. This was supported by the Lake Erie Protection Fund (97-18).

Board 02 VASCULAR PLANTS INVENTORY OF A PORTION OF MINUTE MAN NATIONAL HISTORICAL PARK, MA. Julia C. Wilcox, Hiram College, Dept. of Biology, Hiram OH 44234. wilcoxjc@hiram.edu

A detailed inventory of vascular plants was conducted of a 12 ha region of Minute Man National Historical Park in July and August of 1999. Within this region, early successional mixed pine, oak, and maple forests surround two vernal pools and a red maple swamp. The botanical composition was recorded, and the species density, distribution, and herb/shrub cover was estimated. Dominant trees included *Acer rubrum, Pinus strobus, Quercus velutina, Quercus rubra,* and *Nyssa sylvatica.* Dominant shrubs included *Clethra alnifolia, Vaccinium corymbosum, V. angustifolium, Rhamnus frangula,* and *Rhododendron viscosum.* Overall plant community structure and floristic composition were comparable to other northeastern red maple swamps. Numerous exotic plant populations, which threaten the region's natural succession, were recorded. Management options concerning the exotic populations are proposed, with isolated exotic populations that are highly invasive and found within wetland habitat being considered the highest priority for removal. Using these criteria, *Lythrum salicaria* populations within the vernal pools are of greatest concern, followed by isolated populations of *Rhamnus frangula, Celastrus orbiculatus, Berberis thunbergii,* and *Rosa multiflora.*

Board 03 MOLECULAR METHOD OF IDENTIFICATION OF MICROORGANISMS IN THE FILM COVERING THE EYES OF THE HORSESHOE CRAB. Neely N. Nelson[1], Rachel Lamb[2], Min-Ken Liao[2], [1]Ohio Northern University, Dept of Biology, Ada OH 45810 and [2]Hope College. n-nelson@onu.edu

A method adapted to the extraction, amplification, isolation, and sequencing of ribosomal DNA, one of the most conserved macromolecules in cells, was developed to phylogenetically identify the microorganisms located in the film covering the eyes of the horseshoe crab, *Limulus polyphemus.* The PCR products obtained using SP6 and T7 primers for the amplification of the bacterial 16S ribosomal DNA from the eye sample were cloned into pGEM-T Easy (Promega) vectors and transformed into XL-1 Blue *E. coli.* Gel electrophoresis analysis, after HindIII and EcoR1 double restriction digests, determined the presence of insert and the concentration of plasmid DNA. Three isolated colonies of XL-1 Blue *E. coli* containing insert yielded sufficient concentrations of DNA required for sequencing. In the future, sequencing followed by computer analysis and database comparison will identify the bacteria.

Board 04 ETHYLENE INHIBITION OF GRAVITROPISM IN CUCUMBER HYPOCOTYLS. Grant M. Barkley, Kent State University, Dept of Biological Sciences, 4314 Mahoning Ave N.W., Warren OH 44483. gbarkley@kent.edu

Ethylene inhibition of elongation growth and induction of lateral growth in dicot stem tissues involves sequential and complex biochemical changes. Ethylene treatment inhibits elongation and increases lateral growth with both events occurring simultaneously within 150-180 minutes. Ethylene induction and maintenance of these responses is auxin dependent, increases cell wall expansins and cell wall acidification. A related action of ethylene is the pronounced effect on stem gravitropic response. Normal hypocotyl response to gravitropic stimulation begins within 10-15 minutes. The induction of rapid geostimulation in cucumber hypocotyl is shown by RT-PCR to be accompanied by a parallel increase in cucumber expansin 1 [Cs-Exp1]. in the lower half of the geostimulated stem. Pretreatment of vertical cucumber seedlings with ethylene [10 mL/L] prior to gravitropic stimulation decreases the rate of stem curvature in proportion to pretreatment time. Stem response to gravistimulation, with or without ethylene, begins rapidly [within 10 min.] indicating normal graviperception. Ethylene impairment of cell elongation is partially relieved on the lower side of gravistimulated hypocotyls resulting in stem curvature. Since pretreatment with ethylene results in uniform acidification and increased expansin expression in both upper and lower halves of the hypocotyl, changes in growth reflects a change in cell wall extensibility and reshuffling of wall bonds in cells on the lower side of the hypocotyl. This implicates differential expression of expansins and regulation of growth in the lower half of the geostimulated hypocotyl.

Board 05 EFFECTS OF LONG-TERM SLUDGE TREATMENT ON HEAVY METAL CONTEENT AND PHOTOSYNTHETIC CHARACTERISTICS IN *SOLIDAGO CANADENSIS*. Brian W. Dunn and Alfredo J. Huerta, Miami University, Dept of Botany, 312 N Elm St, Oxford OH 45056. dunnbw@muohio.edu

It is well known that Cd and Mn are heavy metals that can reach toxic levels and have the potential to bio-accumulate throughout the food chain. Sewage sludge, a product of municipal wastewater treatment, is known to contain high amounts of these metals as well as other heavy metals, toxic organic chemicals and pathogens. Sewage sludge also contains significant amounts of N, and P, which plants need, and is therefore, a commonly applied fertilizer. Previous research conducted at the Ecology Research Center at Miami University, showed that the *Solidago canadensis* (goldenrod), accumulated significantly higher amounts of Cd and Mn from sludge treated soils than from untreated soils. This current research was conducted in order to determine Cd and Mn tissue concentrations and the effects that these have on photosynthesis. We hypothesized that Cd and Mn concentrations in leaves from sludge-treated plots would be significantly higher than in leaves from control plots and that the sludge concentrations would have adverse effects on the photosynthetic characteristics of *Solidago canadensis.* We found that the concentrations of these two metals were significantly higher in leaves of *Solidago canadensis* grown in sludge-treated plots than in leaves from control plots. However, the concentrations of metals that we found did not lead to reduced CO_2 fixation capacity or significantly modified fluorescence parameters. This suggests that the heavy metal concentrations found in the leaf tissue were not high enough to cause physiological damage to this species.

Board 06 REPRODUCTIVE OUTPUT DIFFERENCES AS A FUNCTION OF POPULATION SIZE IN THE OAK SAVANNA PERENNIAL PLANT *LUPINUS PERENNIS*. Marcus C. Chibucos, Bowling Green State University, Dept of Biological Sciences, Bowling Green OH 43403. mchibuc@bgnet.bgsu.edu

As human encroachment progressively fragments natural areas, increasing research focuses on the correlation between size and survivorship of natural populations. I looked at indicators of reproductive fitness in six populations of the perennial oak savanna plant *Lupinus perennis*, which is recognized as the sole larval food source of the Federally Endangered Karner Blue Butterfly. This work is part of a larger study seeking to quantify variation in developmental stability with increasing environmental stress (e.g. shade) as a function of population size. I tested the hypothesis that large populations (2500 to 5000 individuals) exhibit greater reproductive output than small populations (fewer than 1000 individuals) by quantifying the number of ovules produced per seedpod and seeds produced per ovule. In June of 1998, pods were collected from six *L. perennis* populations ranging from 500 to 5000 individuals in northwest Ohio and Southern Michigan. The total number of ovules per pod was summed and each ovule was assigned to one of three discrete development classes: unexpanded (unfertilized), aborted, or mature (seed). These count data were analyzed using the appropriate general linear model and regression analyses. We found a significant linear correlation between population size and number of ovules per pod. However, the number of aborted ovules also increased with population size, resulting in a net mature seed output approximately the same for all populations. These results will be incorporated with analyses of seed weight, germination and growth on an environmental gradient in order to better understand reproductive differences between the six different sized populations.

Board 07 *HSP16.6* GENE EXPRESSION IN THE UNICELLULAR CYANOBACTERIUM, *SYNECHOCYSTIS* SP. PCC 6803. Feng Fang, Daniel J. Prochaska, Susan R. Barnum, Miami University, Dept of Botany, Oxford OH 45056. barnumsr@muohio.edu

The heat shock response is an adaptation found in all living organisms that is characterized by heat shock proteins (HSPs), expressed transiently in response to elevated temperatures. At normal growth temperatures, these heat shock proteins are present in low concentrations (or not at all). However, during heat stress their concentration increases dramatically. Work in our laboratory has demonstrated that *hsp16.6* from *Synechocystis* cells plays an important role during heat shock. In this study, we have examined the effect of different environmental factors on the expression level of *hsp16.6*. In addition, we have determined the transcriptional start point by primer extension. Our results demonstrated that *hsp16.6* was induced by heat shock and high light intensity, but not by cold shock. Primer extension was conducted to identify the transcriptional start point. Results showed that RNA transcription during exposure to ambient temperature, heat shock, and high light intensity was initiated from the same transcriptional start point. This suggests only one promoter is present; however, typical −10 and −35 sequences are not observed. A 266 bp region upstream and contiguous with the translational site cloned from *Synechocystis* cells was fused with the *LacZ* reporter gene. The *LacZ* gene was not induced in *E. coli* cells, although the promoter region of *hsp60* (class I gene) from *Synechocystis* cells could induce *LacZ* expression.

Board 08 EPIDEMIOLOGICAL INVESTIGATION OF CLINICAL ISOLATES OF *PSEUDOMONAS AERUGINOSA* BY IMMUNOLOGICAL, BIOCHEMICAL, ANTIBIOGRAM, AND DNA ANALYSIS. Courtney C. Brickner, R. J. Jamasbi, S. J. Kennel, L. J. Foote, and E. D. O'Donnell. Bowling Green State University, Dept of Biological Sciences, Bowling Green OH 43402. brickcc@hotmail.com

In this study, the phenotypic and genotypic characteristics of *P. aeruginosa* serotypes 0:3, 0:6, and 0:11 obtained as individual clinical isolates from a Northwestern Ohio hospital, were investigated to determine their relatedness. A total of 106 isolates were serotyped by ELISA using three specific monoclonal antibodies (mAbs to serotype 0:3, 0:6, and 0:11). The mAbs reacted with 65.1% of the clinical isolates: 48, 11, and 10 strains were serotyped as 0:11, 0:6, and 0:3, respectively. Serotype 0:11 was predominant, accounting for 45.3% of the isolates. Variations among and within each serotype were also studied by the determination of antigenic heterogeneity, biotyping, β-galactosidase production, antibiogram, and DNA analysis. Significant antigenic variation was observed among and within the three serotypes. Biotyping yielded slight variations. β-galactosidase was produced by 31.8% of serotype 0:11 isolates. The susceptibility testing using seven antibiotics (amikacin, aztreonam, ceftazidime, ciprofloxacin, gentamicin, tobramycin, and piperacillin) also varied. All of the serotype 0:6 isolates were susceptible to the seven antibiotics used, while 50% of serotype 0:3 isolates and 30% of serotype 0:11 isolates exhibited resistance to one or more of the antibiotics. Representatives of each serogroup were analyzed with PCR-based DNA analyses to determine the genetic relatedness among and within each serogroup. The results showed that a combination of phenotyping and genotyping is useful for strain differentiation of *P. aeruginosa* isolates in epidemiological studies.

Board 09 A BIOLOGICAL AND PHYSICOCHEMICAL ASSESSMENT OF FREELAND'S CAVE, ADAM'S COUNTY, OHIO (1998-1999). Elizabeth M. Hagen, Wittenberg University, Dept of Biology, P.O. Box 720, Springfield OH 45501-0720. s01.ehagen@wittenberg.edu

Freeland's Cave, Adams County, Ohio, is a significant cave based on its size (708m total horizontal length) and diversity of aquatic and terrestrial fauna (52 species). The objective of this research was to compare current (November 1998-October 1999) species abundances, distributions, and stream physicochemical characteristics to previous studies conducted in 1985 and 1996. One species of importance is the troglobitic carabid beetle, *Pseudanophthalmus ohioensis*, which is endemic to Freeland's Cave. The density of *P.ohioensis* is affected by seasonal changes, with population size highest during the months of July through September, and lowest from February through June. Observed population size ranged from 0 to 38 beetles per visit to the cave. These variations are linked to low water levels during summer months, which expose more of the preferred mud bank habitat. The distribution of *P.ohioensis* positively correlates with sections of the cave having greater areas of preferred habitat. This association also was noted with other biota, most species tending to utilize the cave in summer and fall months. Microhabitats examined include the stream (pool and riffle substrates ranging from silt to cobble sized particles), mud banks, walls, and ceilings. Among physicochemical parameters, air temperature ranged from 10-14°C, water temperature varied from 6-14°C, dissolved oxygen concentration fluctuated from 8-11mg/l, and pH values ranged between 6.81-9.20. Physicochemical characteristics were affected by precipitation and season. These and biological data were similar to those from 1985 and 1996 studies.

Board 10 A COMPARISON OF TWO COLLECTION METHODS FOR ASCERTAINING PRESENCE OF SELECT AQUATIC INSECT ORDERS: GREAT MIAMI RIVER, BUTLER AND HAMILTON COUNTIES, OHIO. Mark A. Schlueter[1] and Jan Trybula[2]. [1]Xavier University of Louisiana, Dept of Biology, New Orleans, LA 70125. maschlue@xula.edu[2]Miami University.

In the past three decades, aquatic insects have served as important indicators of environment quality. Although much information and data have been collected on aquatic insects, the majority have come from studies on small streams. In the present study, we examined the diversity of Ephemeroptera (mayflies), Odonata (damselflies and dragonflies), Plecoptera (stoneflies) and Trichoptera (caddisflies) at four sites on the Great Miami River. Larvae were collected by dip nets and scraped from rocks. Diversity data were compared with previous data from 1998 when adult insects were collected with UV light traps. Several differences were noted between the two years. Using the dip net method, the Ephemeroptera were the most abundunt (over 85% of the collection at most sites). In 1999, the most common collected Ephemeroptera family was Heptageniidae (90% of all mayflies), which was absent from the 1998 collection. The differences in organism found by collection method indicates that several collection methods should be included to more accurately measure organism presence. The 1999 diversity results do agree with the 1998 results and suggest that the Great Miami River is moderately impacted.

Board 11 MARINE GASTROTRICHA OF ISRAEL: PRESENT STATUS. William D. Hummon, Ohio University, Dept. of Biological Sciences, Athens OH 45701. hummon@ohiou.edu

Beach sand was collected by WD and MR Hummon during September 1999 from the Mediterranean and Red Sea Coasts of Israel. Samples were processed in Jerusalem and Athens, Ohio. Specimens were extracted using $MgCl_2$ decantation, mounted onto slides, viewed under DIC optics at 10x-60x oil, and images captured on Hi8 videotape. Site records increased from 36 in 1992 to 213 (Med), and from 44 in 1992 to 128 (Red). Species known for Israel increased from 20 to 49 (Med), with seven species new to science, and from 30 to 42 (Red), with three n.spp. with one n.gen. Video records increased from 40 to 124 (Med), and from 60 to 110 (Red), with 96% (Med) and 100% (Red) being represented from one or more locations. Cumulative work from Greece, Cyprus, Egypt and Israel, with ~160 (Med) and ~90 (Red) species based on ~1200 (Med) and ~600 (Red) site records, indicate only <33% of RS species in common, most of those species occurring elsewhere in the world as well. Contrary to usual expectations, there is ~10% endemism in the EMed, as well as a higher percentage expected from the Red. Most EMed species also occurred in the WMed, many into the NAtlantic, and some even across/around into the New World, probably via an ancient Tethys distribution. Differentiating between Tethys relects separated for 16 million years and Lessesepsian migrants that have crossed from Red to Med in the last 130 years requires careful analysis, but several shared species show minor morphological deviations.

Board 12 IMPACT OF VERMICOMPOST-AMENDMENTS ON DEVELOPMENT OF PYTHIUM DAMPING-OFF OF CUCUMBER. Amanda K. Brickner[1], Rola M. Atiyeh[2], Michael J. Boehm[3], and Clive A. Edwards[2]. [1]Miami University, Dept of Zoology, Oxford, OH 45056, [2]Ohio State University, Dept of Entomology, [3]Dept of Plant Pathology. Bricknak@muohio.edu

The use of compost-amended potting mixes to naturally suppress soilborne fungal diseases such as those caused by *Pythium* and *Phytophthora* species is well documented. Little however, is known about the disease suppressive qualities of vermicompost. Vermicomposting offers an environmentally sound alternative for the recycling of organic wastes and may help alleviate many of the issues currently facing Ohio and other agriculturally based states in regards to manure management. The goal of this research was to determine the ability of vermicompost-amended potting mixes to naturally suppress Pythium damping-off caused by *Pythium ultimum*. A cucumber-*P. ultimum* bioassay was used to assess the impact of vermicompost-amendments on disease severity. Container media consisted of Metro-Mix 360, a standard greenhouse potting media, and 10, 20, or 40% (by volume) vermicompost. Vermicompost-amendments to a disease conducive potting mix rendered the amended mix suppressive to Pythium damping-off. Autoclaving of vermicompost prior to amendment negated the suppressive effect indicating the phenomenon was biological in origin. This experiment was performed twice. Vermicompost amendments may provide yet another tool for managing soilborne diseases like Pythium damping-off and may provide with an environmentally sound alternative for managing organic waste.

Board 13 GENETIC VARIATION IN *BOTRYCHIUM DISSECTUM* SPRENGEL (OPHIOGLOSSACEAE) ASSESSED BY ISSR (INTER-SIMPLE SEQUENCE REPEAT) MARKERS. Michael S. Barker (Warren D. Hauk), Denison University, Slayter Box 327, Granville OH 43023. barker_m@denison.edu

Botrychium dissectum Sprengel (subgenus *Sceptridium*), like other members of the genus *Botrychium*, is putatively self-fertilizing. Infraspecific variation occurs in the blade shape and degree of blade dissection, and some morphological variants have been described as distinct species. The purpose of this research is to examine infraspecific genetic variation of *B. dissectum* using ISSR (Inter-Simple Sequence Repeat) markers. Populations of *B. dissectum* were collected from the Denison University Biological Reserve (DUBR) and other sites throughout central Ohio. Individuals from these populations exhibit morphological variation representative of the species. Using ISSR markers, we are assessing the genetic structure among 10 populations of *B. dissectum* distributed through central Ohio. Morphological variation will be compared to ISSR marker variation to provide insight regarding species limits. At this time, we are collecting *B. dissectum* populations, and extracting DNA from leaf tissue.

Board 14 FALL MANAGEMENT AND DEFOLIATION IMPACT ON *ALLIARIA PETIOLATA*. Colleen A. LeFevre (Sally M. Waterhouse). Ohio Wesleyan University, Delaware Ohio 43015. calefevr@cc.owu.edu

Alliaria petiolata (Garlic Mustard) is a non-native, biennial, invasive plant species. It has been observed to displace native species and spread very quickly and easily throughout several areas in North America. The purpose of this research is to determine the ability of first-year *Alliaria petiolata* to cope with various stresses applied to the plants in the fall. I hope that by learning more about the limit of tolerance of over-wintering plants that I will discover an effective, non-damaging fall management technique. My hypothesis is that since photosynthesis is reduced in winter and there is reliability primarily on storage, the plant is more susceptible to stresses in the fall, and damage to the taproot and foliage will result in the destruction of the plant. There are two experimental set-ups. Each consists of 3 groups of plants that received a different stress (leaves cut at 2 cm above the taproot, taproot cut at the very top, and the taproot cut at the point at which it enters the ground) and one control group in which the plants were not damaged. One experiment was performed entirely in a Conviron 1-E15 growth chamber. The other was left *in situ* (Ohio Wesleyan University Kraus Preserve). Preliminary growth chamber results show that *Alliaria petiolata* is able to recover from all the experimental stresses. The *in situ* results are not yet available.

Board 15 THE DEPENDENCE OF DIFFERENCES IN CARBON ISOTOPE FRACTIONATION OF CH_4 BY RICE PLANT TRANSPORT ON CULTIVAR AND PLANT AGE. Rebecca S. Bilek[1], William C. Hockaday[1], Stanley C. Tyler[2], [1]Muskingum College, Dept. of Chemistry, New Concord OH 43762. rbilek@muskingum.edu and [2]University of California-Irvine.

Methane emissions from rice agriculture have been shown to be dependent on cultivar type. Recently, isotope studies have been employed to determine the extent to which

production and oxidation processes contribute to observed differences in CH_4 emissions between cultivars under identical growing conditions. In order to more accurately interpret $\delta^{13}C$ data for this purpose, it is necessary to quantify the degree to which carbon isotope fractionation resulting from plant mediated transport is dependent on cultivar type and plant age. A laboratory experiment, in which rice roots were immersed in an aqueous CH_4 solution while the remainder of the plant was contained in a chamber, allowed the diffusional fractionation due to transport to be determined without interference from other fractionating processes. Samples taken by this method from Mars and Lemont cultivars, grown hydroponically in a greenhouse, showed $\delta^{13}CH_4$ fractionation to be independent of cultivar type. However, the degree of fractionation was found to increase with plant age. At approximately 70 days after germination, Lemont plants shifted the $\delta^{13}C$ of emitted methane to values which are 12.6 ± 1.1‰ (n= 6) lighter than the initial methane pool. At the same age, the shift observed for the Mars cultivar was 12.2 ± 1.7‰ (n=5). At 103 days after germination, the degree of isotope fractionation had increased to 14.1 ± 0.8‰ (n=6) for Lemont and to 14.5 ± 0.7‰ (n=5) for the Mars cultivar.

Board 16 THE EFFECTS OF NATURAL, LONG TERM DROUGHT CONDITIONS ON AMPHIDROMOUS MIGRATION INTO STREAMS OF MAUI, HAWAII. Brian T. Condon, M. Eric Benbow, Leslie L. Orzetti, Mollie D. McIntosh, Tim M. Fernandes, M. Nicole Moseley, Albert J. Burky, Carl M. Way, University of Dayton, Dept of Biology, Dayton OH 45469-2320. condonbt@flyernet.udayton.edu

The streams of Hawaii are becoming dewatered for anthropogenic demands, which interrupts the life cycle of several amphidromous species (four gobies, one eleotrid, one shrimp and one limpet). The amphidromous life cycle involves adult reproduction in streams where eggs hatch and larvae are swept to the ocean for a period of obligatory growth and development. Postlarvae migrate back into the streams for growth to reproductive stage. In this study, we address the effects of water removal compounded by drought on the recruitment of the returning postlarvae in five streams on the island of Maui. We quantified postlarval migration from the ocean using modified Breder traps.When all streams were pooled, there was a significant positive relationship between mean daily discharge and recruitment. Migration in the stream with highest mean daily discharge (i.e. Hanawi Stream) was from one to two orders of magnitude greater than the streams with discharge almost one order of magnitude lower. Further, recruitment into all streams was greatest in early July and steadily decreased through October corresponding to periods of high and low discharge, respectively. By the end of October, fish recruitment was near zero in all streams except Hanawi. The decrease in recruitment over the study period is related to low stream flow conditions due to the drought. This explanation is consistent with our hypothesis that increased stream flow acts as a cue for upstream migration from the ocean and previous studies correlating adult reproduction with increased stream flow.

Board 17 A REVIEW OF THE STYGOBITIC CRAYFISHES OF NORTH AMERICA WITH NOTES ON A NEW SPECIES FROM MISSOURI. Horton H. Hobbs III, Wittenberg University, Dept of Biology, P. O. Box 720, Springfield OH 45501-0720. hhobbs@wittenberg.edu

Currently, 38 species and subspecies of stygobitic (obligate cave species) crayfishes are described from North America (inclusive of Mexico and Cuba) and are assigned to one of four genera: *Cambarus, Orconectes, Procambarus,* and *Troglocambarus*. Within the contiguous United States these cave-adapted crustaceans occur primarily in the karst regions of the Appalachians, Interior Lowlands, Florida Lime Sink, and the Ozarks. Eleven species of *Cambarus* (4 subgenera) are known from the Ozarks, the Interior Lowlands, and the Appalachians; seven species and subspecies of *Orconectes* are found in ground waters of the Interior Lowlands; 14 species and subspecies of *Procambarus* are recognized from Florida and Alabama; and the monotypic *Troglocambarus* is limited to ground waters in north-central Florida. The genus *Procambarus* also is represented in subterranean waters in Cuba (one species) and Mexico (four species assigned to two subgenera). During August 1999 two adult (female and Form I male) individuals of an undescribed, blind, albinistic species of *Orconectes* were captured from a stream pool in a cave in the Caney Mountain Conservation Area, Ozark County, in south-central Missouri. These specimens represent the first stygobitic member of the genus found outside of the Interior Lowland Plateau and, importantly, west of the Mississippi River. The locality for this species lies geographically between the known ranges of the disjunct populations of *Cambarus* (*Erebicambarus*) *hubrichti* Hobbs and *Cambarus* (*Jugicambarus*) *setosus* Faxon. Additional field work will lead hopefully to the discovery of other populations and the description of the new species is in progress.

Board 18 GENETIC ANALYSIS OF CAVE AND SURFACE CRAYFISH. Jason D. Moon (Margaret A. Goodman), Wittenberg University, P.O. Box 720, Springfield OH 45501-0720. s00.jmoon@wittenberg.edu

Cave crayfish are generally thought to belong to isolated populations, that is, they mate only with crayfish in the cave system itself and not with crayfish on the surface or in other caves. Recently cave crayfish have been found in well water, suggesting that populations may not be entirely isolated. By comparing genetic samples from crayfish in several cave systems and streams in Indiana, we will develop a measure of the relatedness of cave crayfish, and hence, determine whether cave populations are completely isolated. This summer, pleiopods and chelicerae from *Orconectes rusticus*, a crayfish in the same genus as the cave-dwelling species *O. pellucidus*, were collected from Buck creek, located downstream of the C.J. Brown reservoir north of Springfield, OH, and DNA was isolated. RAPD-PCR (Randomly Amplified Polymorphic DNA – PCR), a process used to amplify random regions of the DNA, was performed to compare the relatedness of individual crayfish. These techniques were developed over the summer and fall of 1999 and will be used to compare cave crayfish and crayfish from surrounding streams.

Board 19 POPULATION DYNAMICS OF SIX OF OHIO'S BREEDING GRASSLAND BIRDS. Claudia R. Steele[1], James S. McCormac[2], Michael A. Hoggarth[1], [1]Otterbein College, Department of Life and Earth Sciences, Westerville OH 43081 and [2]Ohio Department of Natural Resources, Division of Natural Areas and Preserves. ClaudiaRS@email.msn.com

Historically, grassland birds nested in farm fields in the flatter areas of glaciated Ohio. In the last several decades, however, many of these agricultural habitats have been developed into residential and commercial areas. Agricultural areas that have not been developed have been plowed and harvested several times a year, thus disrupting the nesting habits of grassland birds. Reclaimed strip-mines in eastern, unglaciated Ohio currently provide the largest contiguous grassland habitat for this avifauna. This study documents the population dynamics of six grassland birds in a total of eight counties in the state of Ohio over the past one hundred years. The grassland birds used in this study were the bobolink (*Dolichonyx oryzivorus*), dickcissel (*Spiza americana*), Henslow's sparrow (*Ammodramus henslowii*), grasshopper sparrow (*Ammodramus savannarum*), northern harrier (*Circus cyaneus*), and short-eared owl (*Asio flammeus*). The four glaciated Ohio counties examined were Ashtabula, Clinton, Lucas, and Paulding, while the unglaciated counties surveyed for those species were Belmont, Coshocton, Lawrence, and Muskingum. Current population data were collected during a survey of four wildlife areas, which contain reclaimed strip-mines, in the above mentioned unglaciated Ohio counties. Historic population data for the six grassland bird species were gathered from a literature review of many Ohio ornithologists. It was found that during the first half of the century, the populations of grassland avifauna were highest in the glaciated Ohio counties where agricultural grasslands provided abundant nesting habitat. In contrast, the reclaimed strip-mines of unglaciated Ohio have provided the necessary habitat for these large populations of grassland birds over the last several decades. These findings suggest possible management options for reclaimed strip-mine grassland habitat.

Board 20 CHANGES IN FOREST DYNAMICS OF A SOUTHWEST OHIO STAND OVER A 21-YEAR PERIOD. Melanie A. Baker, Kristin M. Bolzman, Timothy L. Lewis, Wittenberg University, Dept of Biology, Springfield OH 45501. s00.mbaker@wittenberg.edu

Small, isolated woodlots cover much of the Midwest. Long-term studies of forest dynamics are useful for management of these areas in Ohio. We measured dominance (as evidenced by basal area), density, and frequency of such a typical beech-maple forest at Aullwood Audobon Center and Farm in Montgomery County, Ohio. All trees greater than 10 centimeters DBH in 66 five-meter radius plots were measured in 1978 and then again in 1999. We measured each tree's diameter at breast height, distance from the center of the plot, and recorded the species of the tree. Results showed that maples (*Acer* spp.) remain the most dominant over a 21-year period occupying 32% of the forest basal area. The relative dominance of the maple (*Acer* spp.) declined from 37% to 32%. The relative dominance of American beeches (*Fagus grandifolia*) increased from 16.8% to 19.3%. Analyzing frequency data showed that black cherry (*Prunus serotina*) and ash (*Fraxinus* spp.) were the most frequent in 1978 but maples were the most frequent in 1999. Possible explanations for these changes include interspecific competition, the presence of pollution, and the influence of the woodlot surroundings.

Board 21 THE EFFECT OF FLOWERING PHENOLOGY ON REPRODUCTION IN *LUPINUS PERENNIS*. Constance E. Hausman[1], Helen J. Michaels[1], and Randall J. Mitchell[2], [1] Bowling Green State University, Dept of Biological Sciences, Bowling Green OH 43403, romanc@bgnet.bgsu.edu, and [2] University of Akron, Dept of Biology, Akron OH.

Variation in flowering time may influence reproduction through effects on plant-pollinator interactions and/or resource availability. We examined the effect of within-plant variation in flowering time on components of offspring reproduction in *Lupinus perennis*, a threatened herbaceous perennial of Midwestern oak savannas. We classified all inflorescences on 15 individuals into discrete phenological classes. To prevent seed dispersal, we bagged the inflorescences after senescence of all flowers. Fruit production per flower varied among genets, but was not affected by inflorescence phenology. However, early flowering inflorescences produced significantly fewer seeds per fruit, and had significantly heavier seeds. In a greenhouse experiment seedlings from early inflorescences emerged significantly slightly faster and had significantly more leaflets, while cotyledon leaf area was significantly smaller in seedlings from late inflorescences. These results are consistent with the notion that pollinator limitation may be more important than resources early in the flowering season.

Board 22 COLD TOLERANCE IN SEMI-AQUATIC AND TERRESTRIAL SPRINGTAILS (INSECTA: COLLEMBOLA). Richard L. Stewart Jr. and Joseph D. Varner, Malone College, Dept of Science and Mathematics. 515 25th Street N. W. Canton OH 44709. rstewart@malone.edu

Insects within the order Collembola are among the most abundant and widespread terrestrial arthropods. They can be found on every continent, including Antarctica, making it the arthropod group with the most southerly location. While many Collembola species reside within the leaf litter layer, others may live their entire lives on the surface of water. Besides their use of a furcula for movement, both semi-aquatic and terrestrial Collembola share a great tolerance to endure sub-freezing temperatures. To measure cold tolerance fifty individuals were collected from a local source near the edges of a stream during

February. They were then immediately subjected to a constant temperature of 0.6°C to evaluate their ability to endure low temperatures for extended periods, the samples were evaluated daily and after seventeen days, 2% (1/50) had died. The exposure period continued and by day sixty-three no more Collembola had died, and by day 120 there was 100% mortality. It is obvious that constant exposure to low temperatures (near 0°C) does not appear to contribute to overwintering mortality in these organisms. Low temperature may actually promote longevity by inducing quiescence. We are determining the lower lethal temperature (LLT) for survival by initially exposing cohorts to –15, 10 and 5°C for 2h. Survivorship; dead, moribund, or alive, at these temperatures will then permit further experimentation and reveal the exact LLT determination. We have observed springtials moving on the surface of frozen water pools and know that the LLT for this organism is well below 0°C. Laboratory survivorship will be determined at 23C, in a 12:12 photoperiod for 1 month and no field mortality was determined during this experiment.

Board 23 SURVEY OF THE ABIOTIC AND BIOTIC CHANGES IN A DECIDUOUS FOREST AFTER THE REMOVAL OF LONICERA MAACKII. Cybil R. Franz and Carolyn Howes-Keiffer. Miami University, 4200 E. University Blvd, Middletown OH 45042. franzcr@po.muohio.edu

Lonicera maackii, Amur honeysuckle, is a non-indigenous shrub that is invading many areas of Southwestern Ohio. In 1997, thousands of *L. maackii* stems were removed from two forested plots (33m² ea) at Miami University, Middletown. Stems and roots were removed whenever possible, however some larger shrubs were cut and a systemic herbicide (Crossbow) was applied to the cut surface of the remaining stump. Treatments consisted of removing all of the cut debris from one plot, while leaving the cut stems and debris in the other plot. Plots were monitored for 4 months to determine the frequency of resprouting by *L. maackii*. Results indicated that more re-growth occurred in the plot where the cut debris had remained in the plot. A floristic survey and changes in microclimate (soil moisture, temperature, pH, & light intensity) were measured within the plots and compared with an uncut control plot. Soil moisture, and pH, were determined to be significantly higher ($P < 0.05$) in the control plot when compared with the two cut plots. However, light intensity and temperature were much lower in control plots. There were no significant differences ($P > 0.05$) in light intensity and temperature between the two cut plots. Species diversity was much lower in the cut plots when compared to the control plots. However, survey results two years after removal indicated that diversity and density increased in the disturbed plots while the control plot remained unchanged. It appears that the experimental plots are slowly recovering from the disturbance associated with the cutting/removal activities.

Board 24 THE DROSOPHILA GENOME PROJECT: ANALYSIS OF THE 36B LOCUS. Leokadia K. Okress (Dr. Charles E. Rozek, Case Western Reserve University; Cathleen M. Jenkins), Cuyahoga Community College, Western Campus, 11000 W. Pleasant Valley Rd, Parma OH 44130. cathleen.jenkins@tri-cc.cc.oh

The Drosophila Genome Project originating out of Berkeley, California was started to sequence the genome of *Drosophila melanogaster*, commonly known as the fruit fly. As a component of this project the goal is to create a restriction map of fragments of the *Drosophila* genome. These restriction fragments are smaller pieces of the 120 mb genome and comprise chromosomal locus 36B. This area is vital to understanding gene function and regulation within the muscular and circular respiration systems of the fruit fly. These fragments are formed by restriction digests into a much more manageable size. The resulting 3 kb fragments are then subcloned into a vector plasmid to create a recombinant plasmid. This recombinant plasmid is formed through plasmid DNA isolation, restriction enzyme digests, alkaline phosphotase and ligation reactions, and a final enzyme digest using EcoRI. The resulting fragments are then sized against molecular weight standards and analyzed to uncover overlapping fragments. Through the repetition of this process a restriction map can be formed and the location of each respective fragment can be obtained. My work has encompassed the procedures mentioned above, as well as computer analysis of the fragments formed by the EcoRI digest. This work has yielded one successfully subcloned and analyzed restriction fragment to date.

Board 25 MEMORY DEFICITS IN WOMEN SUFFERING FROM POSTTRAUMATIC STRESS DISORDER RESULTING FROM CHILD ABUSE. Kelly A. Zander, Scott H. Maurer; (Cathy L. Pederson, Patricia L. Kaminski); Wittenberg University, Dept of Biology, P.O. Box 720, Springfield OH 45501. s01.kzander@wittenberg.edu

Posttraumatic Stress Disorder (PTSD) is a mental affliction that is prevalent in victims of childhood abuse. PTSD patients present a myriad of problems including intense fear, avoidance of stimuli related to the traumatic event, and recurring nightmares. Recently, deficits in free verbal recall and short-term memory have been associated with PTSD (Bremner et al. 1995). Our goal is to further explore memory deficits found in PTSD subjects. We are examining female adult victims of childhood abuse who exhibit PTSD (Group 1, n=3). These subjects will be compared to women who have a similar abuse history but do not present PTSD (Group 2, n=3) and controls with no abuse history (Group 3, n=3). All subjects are right-handed women between 20 and 40 years old. Each potential subject was screened using the *Childhood Trauma Questionnaire*, *Trauma Symptoms Inventory*, and *Million Clinical Multiaxial Inventory: Third Edition*. Subjects from each group were carefully matched with subjects from other groups having similar age, general health, alcohol consumption and drug usage ($p > 0.21$ for all indices) to eliminate outside variables that may alter subject performance. On separate occasions, subjects were clinically interviewed, and given the *Wonderlic Personnel Test* and *Wechsler Memory Scale: Third Edition* to test both short and long term memory. Using the MANCOVA while covarying for IQ, a significant difference was shown between groups in auditory memory ($p=0.010$) with a significant deficit for Group 1. No significant differences were found between groups for visual memory ($p=0.147$) or working memory ($p=0.849$).

Board 26 USING MAGNETIC RESONANCE IMAGING TO IDENTIFY ALTERATIONS IN BRAIN MORPHOLOGY IN FEMALE SURVIVORS OF CHILDHOOD ABUSE WITH POST-TRAUMATIC STRESS DISORDER. Scott H. Maurer, Kelly A. Zander (Cathy L. Pederson, Patricia L. Kaminski, Robin Osborn), Wittenberg University, P.O. Box 720, Springfield OH 45501. s00.smaurer@wittenberg.edu

Childhood abuse is increasingly linked to Posttraumatic Stress Disorder (PTSD), a mental affliction which follows abuse survivors into adulthood. PTSD symptomology, which includes intense fear, difficulty sleeping, amnesia related to the trauma, avoidance of stimuli related to the traumatic event, and recurrent nightmares implicates abnormalities in several different brain areas. Currently, MRI based studies are important in the study of PTSD and have shown significant decreases in the volume of the hippocampus, an area of the brain responsible for memory (Bremner et al. 1997). The increasing need for PTSD research focusing on both child abuse and women is apparent. Thus far, we have examined 12 women who will fit into one of three groups: 1. History of childhood abuse resulting in PTSD (n=4), 2. History of childhood abuse not resulting in PTSD (n=4), and 3. No history of abuse (n=4). Each subject was screened using *Childhood Trauma Questionnaire*, *Trauma Symptoms Inventory*, and *Million Clinical Multiaxial Inventory: Third Edition* and clinically interviewed to confirm group assignment. Subjects were demographically matched between groups and received a magnetic resonance imaging (MRI) scan of the brain. We expect the MRI data to show trends for decreased hippocampal volumes in Group 1 when compared with Groups 2 and 3. Repeated measures ANCOVAs of demographic data showed that there were no significant differences between groups in age ($p=0.822$) and body mass index ($p=0.639$). MANCOVAs analysis of smoking ($p= 0.739$) and alcohol use ($p=0.210$) showed no difference between groups.

Board 27 NITROGEN MINERALIZATION UNDER DIFFERING AMOUNTS AND TYPES OF LITTER FALL Thomas G. Bauer (Dr. Charles McClaugherty), Mount Union College, 1972 Clark Ave, Alliance OH 44601. bauerthg@muc.edu

The objective of this research is to determine how the quality and quantity of litter fall affect rates of Nitrogen (N) mineralization. I hypothesized that N mineralization values would be higher in a successional forest than in an old growth forest due to difference in litter quality. I also hypothesized that N mineralization would be proportional to quantity of litter input. Two forests were studied, an old growth Beech-Maple Forest (*Fagus grandifolia- Acer saccharum*) and a nearby successional forest dominated by red maple (*Acer rubrum*). Both forests were located in eastern Stark County, Ohio. Litter input has been manipulated in both forests annually for the past five years by removing all litter from a circular plot (5m radius) and transferring it to an adjacent plot. A third adjacent plot served as a control. The average annual litter fall transfers for the old forest are 937 g/m² and, for the successional forest, 569 g/m². Soil cores (9 per plot) were collected during June and August of 1999 resulting in a total of 54 initial and 54 incubated samples per month. Cores were collected from randomly located points within each plot and samples were incubated for 30 days in the laboratory. N was extracted from initial and incubated samples using 2N KCl per 50g of sample for 48 hours. N mineralization was determined as the net change in extractable ammonia and nitrate during the incubation. I anticipate higher values for N mineralization as litter fall amount and forest age increases.

Board 29 DEVELOPING FIELD MAPPING TECHNIQUES FOR FRACTURE IDENTIFICATION AND SPACING IN NATURALLY OCCURRING OUTCROPS-AN EDUCATIONAL EXPERIENCE. Julie Weatherington-Rice, Ann D. Christy, Garry McKenzie, Bennett & Williams Environmental Consultants, Columbus OH 43231 and The Ohio State University, Columbus OH 43210. Weathringtn-rice.1@osu.edu

While the Fracture Flow Working Group has developed methodologies for discovering and mapping fractures in freshly dug pits, the Group is still struggling with suitable techniques for uncovering and mapping fractures in natural outcrops. Natural faces present different challenges; they are usually weathered, covered with slumped materials, and steeply angled. This provides poor footing and vertical faces higher than the 1 meter bench recommended in pit construction. However, outcrops offer the potential to map continuous fractures for significant vertical distances. They also present the opportunity to map across glacial contact boundaries and through paleosols. Accordingly, the Working Group undertook a series of field trips to Clermont County, Ohio, in the fall of 1999 to study Illinoian and pre-Illinoian glacial materials in a natural streamcut outcrop. To overcome the physical barriers created by the natural cut, several methodologies were utilized including ladders, angled trenching shovels, and long-handled hoes. Since the field team was comprised of geologists, soil scientists and agricultural engineers, both professionals and students, the trips were also cross-disciplinary learning experiences, reemphasizing the need for a multi-disciplined team in solving the fracture question.

Board 30 A QUANTITATIVE CONODONT BIOSTRATIGRAPHY FOR THE SALAMONIE DOLOMITE AND THE SALINA GROUP (SILURIAN) OF THE NORTHERN INDIANA SUBSURFACE. Mark A. Kleffner[1], Carl B. Rexroad[2], [1]The Ohio State University at Lima, Dept of Geological Sciences, 4240 Campus Dr, Lima OH 45804-3576 and [2]Indiana Geological Survey. kleffner.1@osu.edu

Previous attempts to determine a conodont biostratigraphy for the upper part of the Salamonie Dolomite and the Salina Group in the northern Indiana subsurface have been

hampered either by a paucity of conodonts, scarce representation of diagnostic conodonts, or a lack of a high-resolution Silurian conodont biostratigraphy for that part of the Silurian to correlate with. Restudy of hundreds of conodont samples processed from cores drilled through the Salamonie Dolomite and Salina Group in northern Indiana in the 1960's and early 1970's indicates that although diagnostic conodonts are scarce, they are present in enough samples from some of the cores to provide the data required to determine a quantitative biostratigraphy and correlation for those units with high-resolution Silurian conodont biostratigraphies recently developed. Ten conodont chronozones and five subchronozones are provisionally recognized for the Salamonie Dolomite and Salina Group in northern Indiana, ranging from the uppermost Llandovery *Pterospathodus amorphognathoides* Chronozone to the lowermost Pridoli lower *Ozarkodina remscheidensis remscheidensis* Subchronozone of the *O. remscheidensis eosteinhornensis* Chronozone. The Llandovery/Wenlock boundary is recognized near the top of the Louisville Limestone Member of the Pleasant Mills Formation or in the lower part of the Wabash Formation, just slightly above the first-appearance datum of *Kockelella variabilis*. The Ludlow/Pridoli boundary is recognized near the top of the Wabash Formation (Kenneth Member, when possible to identify), although the top of the Wabash has apparently been eroded below that boundary in many cores.

Board 31 IMPLICATIONS OF FLOW AND WATER SOURCE ON NITRATE CONCENTRATIONS IN A FEN. Sky Schelle; (Dr. John Ritter); Wittenberg University, Dept of Geology, P.O. Box 720, Springfield, OH, 45501. s00.sschelle@wittenberg.edu

Located in west-central Clark County, the Wenrick Wetland is situated at the boundary between glacial till and outwash along the lower Mad River system and functions to filter chemicals out of that system. Wenrick is presently surrounded by farmland. The purpose of this study is to evaluate wetland function as it relates to changes in water source and flow direction. The objectives are threefold: to investigate the relation of flow stage to water source, the influence of different water sources on water quality, and change in water quality along a flow path that intersects areas of water from different sources. Data collection involves a continuously recording rain gauge, manual sampling, and automated sampling of water using a field spectrophotometer for water analysis. Nitrate analysis uses the cadmium reduction method. Stage data are collected during each visit so that the relation between nitrate's concentration, water source, and flow stage can be understood. Initial observations have shown that flow through the wetland is dominated by groundwater but may also be influenced by flow stage in an adjacent drainage ditch. The wetland is a fen/slope wetland during base flow and a riverine wetland during flood. Flow direction is influenced by groundwater during baseflow stage and overland flow during flood stage. Depending on flow stage, water sources may include combinations of groundwater flow and/or overland flow. The potential for multiple sources of water that are stage-related leads to the hypothesis that nitrate concentrations and water quality in general are dependant on source of water and different flow patterns.

Board 32 AN EFFECTIVE METHOD OF AMENDMENT DISTRIBUTION FOR *IN-SITU* BIOREMEDIATION OF CIS-1,2-DICHLOROETHENE AND VINYL CHLORIDE. Joseph M. Warburton and James A. Peeples, Metcalf & Eddy, Inc., 2800 Corporate Exchange Dr Suite 250, Columbus OH 43231. Joe_warburton@aquaalliance.com

A shallow glacial outwash aquifer at an industrial site in central Ohio was contaminated with cis-1,2-dichloroethene (cis-1,2-DCE), vinyl chloride (VC), soluble petroleum compounds, and residual light non-aqueous phase liquids (LNAPLs). The impacted aquifer had a saturated thickness of twenty-five feet. Enhanced *in-situ* anaerobic dechlorination was chosen as the remedial alternative. A non-recirculating pilot cell was constructed using two injection wells located six feet apart, on an axis parallel to groundwater flow. 150 pounds of sodium bromide was injected as a tracer. Nutrients injected into the downgradient well entered the center section of the pilot cell, and nutrients injected into the upgradient well were distributed along the sides of the cell. Amendment injection was alternated between each well, with groundwater extracted from outside the pilot area injected into the opposing well. A grid of observation wells was monitored for concentrations of bromide, contaminants of concern, and the nutrient amendments. Nutrient and groundwater injection methods were varied to optimize the distribution of amendments in the aquifer. Sampling results indicated a lateral nutrient distribution of approximately 120 feet, and a longitudinal distribution of approximately 600 feet. Effective treatment of the contaminants of concern occurred as far as 400 feet from the injection wells.

Board 33 NEW STACK-UNIT MAP OF DAYTON REGION DEPICTS PLEISTOCENE SEDIMENTS ABOVE BEDROCK. C. Scott Brockman, Gregory A. Schumacher and Douglas L. Shrake, ODNR Division of Geological Survey, 4383 Fountain Sq Dr., Columbus OH 43224-1362. scott.brockman@dnr.state.oh.us

A new map, "Surficial geology of the Ohio portion of the Dayton 1:100,000-scale quadrangle," depicts the"stack" or thickness and stratigraphic sequence of geologic units (materials such as till, gravel, sand, silt, and clay) from the land surface down to and including the uppermost buried bedrock unit. Data for the five-county mapping area came mainly from county soil surveys, ODOT and Ohio EPA boring logs, engineering logs, water-well logs, and theses. Mapping was partially funded by an Ohio EPA 319 grant. The map reveals many previously unrecognized regional trends. For example, in the northern 90% of the map area, upland till generally ranges from 30-50 feet thick. The few upland areas of exposed bedrock or thin drift are significant in that several contain narrows of the Great and Little Miami Rivers. In the southern 10% of the area thin or patchy till dominates; this trend continues southward to the Wisconsinan glacial margin. Drift in the Whitewater Interlobate Plain, centered on Preble County, is primarily thick till (>120 feet) with smaller areas of sand and gravel (<50 feet thick) that lack significant interbedded till. In contrast, thick sand and gravel (>200 feet thick) predominate in the buried valley of the Great Miami River system. Patchy, interbedded till generally is present only within the upper 70 feet of the column; erosion or nondeposition has mostly eliminated earlier tills at depth.

Board 34 STABILITY OF SOIL TEST pH, PHOSPHORUS AND POTASSIUM IN A GRID SOIL TEST SYSTEM, Steven C. Prochaska, Ohio State University-Extension, 117 E. Mansfield St., Bucyrus, OH 44820. prochaska.1@osu.edu

Grid soil sampling (GSS) has recently been implemented by a number of Ohio farmers with the purpose to gather soil test information on small areas of a field. By GSS, field points are geo-referenced thus permitting mitigating treatments of fertilizer or lime to be applied. Further, by GSS, geographic information systems (GIS) can be built by overlaying yield maps, soil type maps, topographic maps, etc. Traditional agricultural crop soil tests (most were of 10 acres in size or larger) and their concomitant results were often quite variable. Thus GSS on .33 acre grids was conducted to examine the stability of soil test P, K, and pH. Variable rate P and K (low 200 lbs/acres to 500 lbs/acre) of 18-46-0 and 0-0-60 were applied 4/23/97 after initial grid soil testing. Six grids were randomly selected from 15 total grids to be further analyzed. Soil samples were taken in the middle of the grid (4 soil probes 8" deep around the all-terrain vehicle equipped with global positioning system equipment) for each test in 1997 and 1998. P soil test levels went up in every grid; K soil test levels actually went down in 3 grids. Average phosphorus values went up 13.3 ppm P/acre and average potassium values went up by 14 ppm K/acre in the area of variable rate fertilizer applications. The increase in P was significant. Soil pH did not change significantly. GSS may allow for more precise applications of fertilizer and lime and thus better protect the environment while improving farm profitability.

Board 35 THE ECONOMICS OF SUSTAINABILITY; TURNING TREE TRIMMINGS INTO CRAFT AND PROFIT AT A FARMER'S MARKET, Frederick John Kluth, 1060 DeLeone Dr. Kent OH 44240-2026. fjk@apk.net

The economics of sustainability was investigated by turning tree trimmings into craft items that were then offered for sale at the local Kent farmers' market. The sustainable aspect was emphasized by using only hand tools and no glue or finish of any kind. Because many different objects were produced the study took the form of a market survey to determine which products could be most profitably produced. For each object the time to produce it and the sale price were recorded, and from these the hourly rate was calculated. The hypothesis was that these rates could be compared to the minimum wage and that there would be differences that could indicate a direction for profitability. Two categories of items were produced, decorative and useful. Within each category, there were several types of products, for a total of 73 individual items in 28 types. A total of 140.75 manufacturing hours resulted in total sales of $70.26 and rates ranging from $.90 to $8.00 per hour. Decorative items resulted in a rate of $3.53 per hour while useful items had a rate of $2.60 per hour but the difference was not significant. The overall average rate of $2.81 was not significantly different from a minimum wage of $5.00 per hour. The results, though interesting, are not significant, so the study is worth repeating over a longer time period during which more items can be made and sold.

Board 36 THE EFFECT OF LITTER ADDITION AND REMOVAL ON CO_2 EFFLUX IN A FORESTED ECOSYSTEM. Tonia L. White (Charles McClaugherty), Mount Union College, Box 1048, 1972 Clark Ave, Alliance OH 44601. whitetol@muc.edu

Carbon dioxide efflux from forest soils is an important component of the global carbon budget. It is also a significant indicator of respiration and decay rates in a forest soil. Carbon dioxide efflux is thought to change with the amount of leaf litter supplied to the system. In this experiment, the amount of CO_2 efflux from the ground was measured for six sites in a forested ecosystem using a Li-cor 6400 portable photosynthesis system. Two sets of plots 5 meters in diameter each were treated as follows: double litterfall (2x), control (1x) and removal (0x). One set was located in a climax Beech (*Fagus grandifolia*) - Sugar Maple (*Acer saccharum*) community while the other set was located in a younger successional stand of Red Maple (*A. rubrum*) - Black Cherry (*Prunus serotina*) that had been clear cut for pasture 150 years ago. The two communities were then compared to see if any differences in CO_2 efflux were noticeable for both the agricultural land use legacy and treatment method (2x, 1x, and 0x). Soil cores were taken in June and August to determine total percent carbon and to note any differences in plots by treatment method and agricultural land use legacy. Preliminary efflux data suggests that the climax forest shows higher rates of CO_2 discharge than the successional forest. For each plot respectively, the 2x plots seem to exhibit greater CO_2 efflux than the 1x and 0x. In each plot there appears to be a significant difference between the 2x and 0x plots, while the efflux of the 1x plot appears to closely parallel the data collected for the 0x plots.

Board 37 LIMITING FEATURES FOR A SMALL HEADWATER STREAM TO SUPPORT FISH LIFE. Nathan A. Moyer (Dr. Lin Wu) Mount Union College, Box 1448, 1972 Clark Ave, Alliance Ohio 44601. Moyernaa@muc.edu

The current biological criteria used for identifying and protecting rivers and streams in Ohio rely upon fish and benthic macroinvertebrates as indicators. This includes small headwater streams, which often do not support any fish life. The goal of this project is to examine one headwater stream and determine features that limit its ability to support fish life. The hypothesis of this study is that pool dynamics and accessibility to the pool will be important. A small headwater stream in the Cuyahoga Valley Recreational Area was selected for this

study because it is good fish habitat. The study was carried out between August and November 1999. Flags were placed at ten-meter stream intervals marking the research area. Using a compass and the flags, a detailed map was drawn showing the stream shape and marking all of the pools present in the stream. The pools were then numbered and the perimeter shape was drawn. The length, width, and depth at many places were recorded for each pool with a meter stick. On October 19 or 23 the number of fish seen in each pool were recorded and using a dip net for ten minutes as many fish as possible were captured. The number captured and length of the fish were also recorded. The percent gradient was recorded at every twenty-meter stream interval and the actual distance between the marks was measured with a 50-meter tape measure. A longitudinal profile of the stream marking pools with and without fish will be made.

Board 38 SOIL CHARACTERISTICS AND VASCULAR PLANT DIVERSITY OF DISTURBED LANDS; PPG LIME LAKES IN BARBERTON OH, AND ABANDONED COAL MINES IN STARK COUNTY OH. Annabelle M. Foos, F. Smith, L. R. Baird, B. A. Clark-Thomas, D. W. Conner, T. E. Conte, J. N. Dennison, C. M. Indriolo, W. K. Laine, A. W. Landaw, F. G. Larkin, K. J. Lobur, J. D. Naus, C. J. Ulle, University of Akron, Center for Environmental Studies, Akron OH 44325-4101. afoos@uakron.edu

Two contrasting areas of disturbed lands were investigated by the analysis of soil characteristics (pH, conductivity, nitrate, and phosphate) and determination of a vascular plant diversity index. Two sites in the Bear Creek watershed of southern Stark County, Ohio, were investigated. The Bear Creek watershed contains a large acreage of abandoned surface coal mine spoils that have produced acid mine drainage. The first site was overgrown and showed no evidence of artificial reclamation. Scot's pines were planted in the second area in an effort to reclaim the site. The vascular plant diversity index of site 1 was higher than site 2. An increase in diversity was noted with an increase of pH, a decrease in conductivity, as well as a decrease in phosphorus levels. The lime lakes of PPG contain waste from soda ash production which consist of fine-grained lime spoil that was alkaline, lacked nutrients, and was unable to support vegetation. Reclamation efforts included mixing the waste with sewage sludge, regrading, and planting of mixed herbaceous and woody vegetation. Test sites included undisturbed as well as younger and older reclaimed sites. Higher vascular plant diversity indices were seen in the undisturbed land as well as the older reclaimed site. Conductivity was highest in the area of recent reclamation and lowest in the undisturbed area. Phosphorous was lowest in the undisturbed and highest in the older reclamation areas. Nitrate showed no significant trend. This study indicates that the reclamation efforts at the PPG lime lakes site were more successful the reclamation efforts at the Stark County abandoned coal mine site.

Board 39 ASSESSMENT OF VEGETATION CHANGES AFTER 13 YEARS OF RESTORATION AT THE MOUNT ST. JOHN/BERGAMO PRAIRIE. Amanda L. Wischmeyer[2] (Leanne M. Jablonski[1], Denis R. Conover[1], Donald R. Geiger[2]), Marianist Environmental Educational Center[1], [2]University of Dayton, Dept of Biology, 300 College Park, Dayton OH 45469-2320. wischmal@flyernet.udayton.edu

Evaluation of prairie species establishment is being used to determine if management intervention is necessary on the Mt. St. John/Bergamo Prairie (Greene County, OH). Restoration began on the 14-acre sand and gravel borrow pit from 1986-88 with 52 species, 82% of these being native. Burning has occurred every 3 years, and more than 120 additional native and nonnative species have volunteered or been hand-transplanted. Complete species lists were compiled in 1988, 1995 and 1999. From these, plant community traits of total species number, diversity, and native species composition have been analyzed. Floristic quality (FQA) is being assessed to incorporate species richness and the coefficient of conservatism of the native prairie species. After 13 years, 77% of species present are native. For each interval between surveys, native species additions outnumbered nonnative volunteers. Largest increases since the initial planting were found in the functional groups of forbs, sedges and vines. The increase in number of native species suggests that the restoration is progressing towards a mature, diverse prairie.

Board 40 ANGULAR MOMENTUM CONSERVATION IN SMOOTH PARTICLE HYDRODYNAMICS. Ivan Tornes, Michael L. Fisher. Ohio Northern University, Dept of Physics, Ada OH 45810. m-fisher2@onu.edu

Smooth Particle Hydrodynamics, SPH, uses integral interpolation theory to solve the equations of fluid dynamics. The equations of SPH are designed to ensure mass, linear momentum and angular momentum conservation. Unfortunately, the SPH method fails to conserve angular momentum for a simple rigid rotator. Fisher and Owen (1995) developed a reformulation of the SPH method based upon mass averaging instead of volume averaging of normal SPH. The new methodology is called Mass Averaged Smooth Hydrodynamics, MASH. The methodology has been shown to correct some of the deficiencies of the SPH method. This paper presents numerical results and validation of the MASH methodology for simple rigid rotators. MASH correctly conserves angular momentum in simple rigid rotators while the SPH method does not.

Poster Session
Medical Sciences
10:00-11:00 AM
Meyer Hall

Board 01 EFFECTS OF THE CANNABINOID AGONIST WIN 55212-2 ON NEURONAL DIFFERENTIATION OF PC-12 CELLS. Kristyn L. Strasser, Heather N. Smith, Talnishia R.J. Williams and Karl J. Romstedt. Capital University, Biology Dept, 2199 E Main St, Columbus OH 43209. kstrasse@capital.edu

Marijuana and other cannabinoids exert influences via cannabinoid receptors which are known to exist on neurons within the central nervous system. Activation of these receptors has been shown to result in the phosphorylation of a neuronal focal adhesion kinase which could have neurotrophic effects (Dirkinderen et al., Science 273: 1719, 1996). The present study was undertaken to determine if the cannabinoid agonist, WIN 55212-2 (WIN) could regulate the differentiation of a neuronal chromaffin cell line (PC-12) *in vitro*. PC-12 cells were observed with no treatment or in the presence of 50 ng/ml nerve growth factor (NGF), WIN or both. Concentrations of WIN ranged from 0.1 to 30 μM. After 4 days, neurite development with NGF reached a value of 186 ± 18 SEM nm per cell (n = 12 cultures). This was significantly greater (t-test, p=0.0009) than growth in controls (110 ± 7). WIN inhibited neurite outgrowth in a dose-dependent manner with 50% inhibitory concentrations of 6.63 and 6.37 μM for NGF-treated cells and controls, respectively. WIN concentrations of 10 μM or greater also reduced the number of viable cells as determined by trypan blue exclusion. However, 3 μM WIN had no significant effect on cell viability. Although WIN inhibited differentiation of these cells, the concentrations required are higher than would be expected for effects mediated via cannabinoid receptors and therefore the observed inhibition could be of a nonspecific or toxic nature.

Board 02 LACTATE DEHYDROGENASE ISOZYME ACTIVITIES IN TWO SPECIES OF BATS. John J. Leskovan (Dr. Sheafor) Mount Union College, 1972 Clark Ave, Alliance OH 44601. leskovjj@muc.edu

Lactate dehydrogenase (LDH) is an enzyme that catalyzes the reversible reaction between pyruvate and lactate. *In vivo*, LDH occurs in two forms, LDH_H, so named for the abundance of this isozyme found in heart tissue, and LDH_M, termed for the large quantities found in skeletal muscle. LDH_H facilitates the conversion of lactate to pyruvate and, therefore, tissues containing high levels of this isozyme favor the use of oxidative metabolic pathways. Tissues containing elevated levels of LDH_M facilitate the reverse reaction and enhance glycolytic ATP synthesis. It has been shown that pikas and hummingbirds (oxidatively stressed endotherms) maintain elevated levels of LDH_H in skeletal muscle. Due to extremely high energetic demands placed on bats during flight, we hypothesize that high levels of LDH_H would be found in their flight muscles. High LDH_H would help to rapidly synthesize ATP without a reliance on anaerobic pathways. This would decrease the buildup of lactate in muscle tissues and limit consequent acid/base imbalances. In this experiment, the composition of LDH isozymes in six major muscles from two common species of bats (Myotis *lucifugus* and *Eptesicus fuscus)* was examined. Native gel electrophoresis will be performed on the extracted tissues and the percentage of each isozyme will be quantified. In addition, spectrophotometric assays will be performed to determine total LDH activity in all tissues. It is hoped that this study will increase our understanding of general muscle physiology as well as the specific adaptations that have evolved in conjunction with volent locomotion in mammals.

Board 03 SIGNAL TRANSDUCTION PATHWAYS INVOLVED IN THE CATECHOLAMINERGIC DIFFERENTIATION OF AVIAN NEURAL CREST-DERIVED CELLS *IN VITRO*. Xiaodong Wu, Marthe J. Howard, Medical College of Ohio, Dept of Anatomy and Neurobiology, Toledo OH 43614. xwu@mco.edu

Growth factors have a pivotal role in the differentiation of neural crest-derived cells into catecholaminergic (CA) neurons. Molecules derived from the neural tube and found in chick embryo extract (CEE), transforming growth factor-ß1, ciliary neurotrophic factor and bone morphogenetic proteins (BMP) all support the differentiation of CA neurons in vitro under growth conditions which alone will not support expression of this phenotype. Each of these identified growth factors binds a cognate receptor whose signal transduction pathways are partially understood. Two broad groups of growth factor receptors, those which have an intrinsic receptor tyrosine kinase or activate soluble tyrosine kinases and those which are serine/threonine kinases and activate the transcription factor SMAD (vertebrate homologue for mothers against decapentaplegic), can influence differentiation of neural crest-derived cells into CA neurons. In the present study, we tested whether mitogen activated protein (MAP) Kinase or SMAD, both of which can influence transcription, mediate the differentiation of neural crest-derived CA neurons in response to CEE or BMP-4. In the presence of Herbimycin A, a pan-specific tyrosine kinase inhibitor, there was a dose-dependent loss of neural crest-derived CA neurons differentiating in 10% CEE. Inhibition of MAP Kinase using PD98059 (a MAP kinase kinase inhibitor) resulted in a dose-dependent reduction of CA differentiation with an IC_{50} of 5.9 μM. In response to PD98059 (7μM), CA differentiation was reduced by 70%, suggesting that CA differentiation of neural crest-derived cells in vitro requires one or more phosphorylation events impinging upon MAP Kinase. Differentiation of CA neurons was increased 202% in response to added

BMP4 (10ng/ml) but was inhibited only 32% when activation of MAP Kinase was blocked by PD98059. BMP-4 induces the translocation of SMAD1 from the cytosol to the nucleus and in 2% CEE medium, added BMP-4 supports CA differentiation as well as the induction of dHAND, a basic helix-loop-helix transcription factor required for the differentiation of crest-derived CA neurons. The data suggest that CEE-derived factors and BMP-4 support the differentiation of CA neurons via independent signaling pathways which may interact. (supported by HD 28184 to MJH.)

Board 04 EFFECT OF CHRONIC COCAINE EXPOSURE ON BENOZDIAZEPINE (BZ) ANTICONVULSANT AND ANXIOLYTIC ACTIONS AND GABA$_A$ RECEPTOR (GABAR) SUBUNIT EXPRESSION. S.M. Lilly, E.I. Tietz, Medical College of Ohio, Dept of Pharmacology, 3035 Arlington Ave, Toledo OH 43614. slilly@mco.edu

Cocaine exposure has been shown to alter rat seizure susceptibility and affect BZ binding density, hypnotic actions, and potential for abuse. Since BZs are used to treat anxiety related to cocaine withdrawal, and also cocaine-induced seizures, we studied the effect of chronic cocaine exposure on the anticonvulsant and anxiolytic actions of diazepam (DZP, a prototype BZ). Changes in GABAR subunit protein expression were also assessed since they also may alter BZ activity at the GABAR. Male Sprague-Dawley rats (130-140 g) were injected with cocaine-HCl (15 mg/kg) or saline 1 X 14 days. All measurements were made 24 hours after the last injection. *Anticonvulsant Testing*: Pentylenetetrazol (PTZ, 20 mg/ml) was infused (0.57 ml/min) via the tail vein and clonus onset was recorded. Previous chronic cocaine exposure had no effect on baseline seizure threshold or DZP's ability (5 mg/kg, i.p., 30 min prior) to significantly ($p \leq .05$) elevate seizure threshold. *Anxiolytic testing*: DZP (1 mg/kg i.p., 30 min prior) significantly increased time spent and entries into open arms of an elevated plus maze (both indicative of reduced anxiety) after saline and cocaine treatment. Cocaine exposure showed a trend ($p=.09$) to increase (+53%) open arm entries, contrary to the expected anxiogenic effects of early withdrawal; a trend not evident 8 days after cessation of treatment. *Immunohistochemistry (IHC)*: Preliminary GABAR subunit protein studies using quantitative IHC demonstrate significant regulation of $\alpha 2$ (-10%) and $\beta 3$ (+9%) subunit proteins in hippocampal dentate gyrus (outer molecular layer) and CA1 (stratum pyramidale), respectively. Despite small changes in GABAR subunit expression in specific brain areas, the clinical effectiveness of DZP likely remains intact following chronic cocaine treatment. Supported by MCO Research Program in Drug Abuse.

Board 05 RESPIRATORY AND CARDIAC RESPONSES TO GRADED HYPOXIA IN THE LUNGLESS SALAMANDER, *DESMOGNATHUS FUSCUS*. Elizabeth A. Sheafor, Stephen C. Wood, Glenn J. Tattersall, Kent State University, Dept of Biological Sciences, Cunnightam Hall Room 256, Kent OH 44242. sheafor@neoucom.edu

The hypothesis that lungless salamanders (*Desmognathus fuscus*) actively respond to hypoxia was tested. Buccal activity (apneic period lengths, minutes/hour of buccal pumping and buccal pumping frequency), heart rate, and metabolic rate were determined during a control period (21% oxygen), hypoxic exposure (2, 5, 6.5, 8 or 10% oxygen), and a recovery period (21% oxygen). Oxygen uptake was regulated at a constant level until a critical oxygen level (Pcrit) between 8 and 6.5% oxygen was reached. Carbon dioxide output increased significantly, but only during 5% oxygen exposure. The amount of buccal pumping observed increased significantly during 5 and 6.5% oxygen exposure, not at other oxygen levels. Heart rate increased at all levels tested except 2% oxygen. The buccal activity and heart rate of lungless salamanders were responsive to environmental hypoxia, with a slight stimulatory response to 10% and 8% oxygen, a significant stimulation during 6.5% and 5% oxygen exposure and no response, or an inhibitory response, to 2% oxygen. During recovery metabolic rate and heart rate returned to control levels within 20 minutes after all hypoxic exposures. Length of the period of apnea increased during recovery, which may suggest a down-regulation or inhibition of buccal activity following hypoxic exposure. The animals actively responded to hypoxia by increasing buccal activity as oxygen levels decreased. This may facilitate oxygen uptake and aid in maintaining metabolic rate during hypoxia. (Research supported by NIH grant HL40537)

Board 06 OSMOTIC STRESS AND p38 MAPK ACTIVATION IN THE BRAIN. Julie M. Niswander, Linda A. Dokas, Medical College of Ohio, Dept of Neurosciences, Rm. 1450 Ruppert Health Ctr, 3120 Glendale Ave, Toledo OH 43614-5809. julniswander@mco.edu

Activation by phosphorylation of p38, a member of the mitogen-activated protein kinase (MAPK) family acts to transduce stress-related signals in eukaryotic cells. In the brain, p38 function has been linked to apoptosis and neurodegeneration, as well as facilitating a proinflammatory response. In this study, the effects of osmotic stress on activation of p38, measured by immunoblotting with a phospho-specific antibody, and on protein synthesis were determined. Osmotic stress was produced in brain slices by the addition of sorbitol to the incubation buffer, producing a hyperosmotic environment. Hyperosmotic stress of brain slices activated p38, most prominently in the hippocampus and cortex. This effect is seen within one hour of onset of osmotic stress and increases over three hours. Although hyperosmotic stress diminishes total protein synthesis in the brain regions studied, as determined by incorporation of ^{35}S-labeled methionine/cysteine into protein during tissue incubation, synthesis of a 35 kDa protein increased in response to osmotic stress. These results are analogous to the situation in yeast, where activation of the p38 homolog under similar osmotic conditions mediates a survival response by inducing glycerol phosphate dehydrogenase (GPDH), the enzyme that generates glycerol, a biologically compatible osmolyte. Of interest to this study, the molecular mass of GPDH is 35 kDa. While the multiple roles of p38 activity in the brain remain under investigation, we offer the suggestion that p38 activation may be an adaptive response to osmotic stress.

Board 07 AMINO ACID CONCENTRATIONS IN CHINCHILLA COCHLEAR NUCLEUS AFTER CARBOPLATIN INJECTION. Yingzhe Li, Donald A. Godfrey, Matthew A. Godfrey, Da-lian Ding, Richard Salvi. , Medical College of Ohio, Dept of Otolaryngology- Head and Neck Surgery, 3065 Arlington Ave, Toledo OH 43614. Yinli@mco.edu

Carboplatin, a drug widely used to treat solid head and neck tumors, selectively destroys both inner hair cells and the major type of auditory nerve fibers (type I) in the inner ears (cochleas) of chinchillas. Using microdissection combined with high performance liquid chromatography (HPLC), the concentrations of 12 amino acids were mapped in the cochlear nucleus (the first auditory center of the brain) of a control animal, which was not subject to carboplatin, and in those of 3 chinchillas injected intraperitoneally 5-6 weeks earlier with 100 mg/kg carboplatin. Widespread destruction of most inner hair cells was confirmed in the carboplatin-injected chinchillas. Concentrations of the amino acid glutamate were lower in several subregions of the cochlear nucleus of carboplatin-injected chinchillas, as compared to the control animal. These included the posteroventral cochlear nucleus (PVCN), in which the average glutamate concentration for injected chinchillas was 40% lower than in the control animal, and the fusiform soma layer of the dorsal cochlear nucleus (DCN), in which glutamate was 24% lower for the injected chinchillas. Glutamine, a direct metabolic precursor of glutamate, was also lower in the injected chinchillas, by 20% in the PVCN and by 27% in the DCN fusiform soma layer. These preliminary results suggest that carboplatin injections affect glutamate metabolism in the cochlear nucleus, probably at least partly through destruction of its type I auditory nerve fiber innervation.

Board 08 CHRONIC BENZODIAZEPINE TREATMENT EFFECT ON EXCITATORY AMINO ACID RECEPTOR (EAAR) STRUCTURE AND FUNCTION. Bradley J. Van Sickle, X.J. Zeng, S. Chen, A.S. Cox, K. Schak, and E.I. Tietz, Medical College of Ohio, Dept of Pharmacology, 3035 Arlington Ave, Toledo OH 43614-5804. Bvansickle@mco.edu

Studies of g-amino butyric acid receptor (GABAR) function in CA1 pyramidal cells of flurazepam (FZP)-treated rats revealed increased monosynaptically-evoked excitatory post-synaptic potential (EPSP) amplitude and a late GABAR-mediated depolarizing potential after high-intensity orthodromic stimulation. EAAR were studied using structural and functional approaches. Changes in α-amino-3-hydroxy-5-methylisoxazole-4-propionate receptor (AMPAR) and N-methyl-D-aspartate receptor (NMDAR) mRNA were studied using *in situ* hybridization. Changes relative to matched untreated control rats were examined immediately (0 days), 2 days and 7 days after ending one-week oral FZP treatment. At 2 days, NMDAR subunit NR2B mRNA expression decreased in hippocampal areas CA1 (-19.4%) and CA2 (-24.1%). At 7 days, AMPAR subunit GluR2 mRNA decreased in CA1 (-43.5%) and CA2 (-37.0%). No significant changes were found for NR1 or NR2A mRNA. Quantitative immunohistochemistry at 2 days detected decreases in NR2B immunoreactivity in area CA1: stratum oriens (-17.7%); stratum pyramidale (-18.8%) and CA2: stratum oriens (-25.8%); stratum pyramidale (-25.3%). EAAR-mediated function was examined in CA1 pyramidal cells from rats 2 days after ending FZP treatment using whole-cell voltage clamp techniques. Miniature excitatory post-synaptic currents (mEPSCs) were recorded in 10 mM glycine, 10 mM bicuculline, 25 mM CGP-35348, and 1mM tetrodotoxin. At V_H =-80 mV, there was a significant difference in the amplitude of AMPAR-mediated events (CON: -11.0±0.9 pA; FZP: -14.1±0.4 pA; $p<0.05$) with no change in event decay (CON: 15.0±1.1 ms; FZP: 14.4±0.8 ms). Further studies will examine potential changes in the AMPAR- and NMDAR-mediated components of spontaneous and evoked EPSCs.

Board 09 DISORDERED EATING DETERMINANTS NOT CLASSIFIED AS FULL BLOWN EATING DISORDERS. Kathryn L. Hempstead, Elizabeth J. Thompson, (Diana M. Spillman), Miami University, 208 Phillips Hall, Oxford, OH 45056. spillmdm@muohio.edu

The female figure is often portrayed in the media as the image of beauty: perfect, tall, fair and very slim. Women are surrounded by these images in every aspect of current culture. These projected perfect bodies become the basis of self-comparison for women. In the search to equate or reach the ideal body image, dysfunctional eating patterns and poor self-esteem often occur. It is suspected that a group of women who may not qualify as textbook anorexics and bulimics but possess behaviors of disordered eating exists. Whereas anorexics and bulimics hold negative attitudes about their entire body, these individuals with disordered eating only view certain parts of their bodies as less than ideal. Extensive case studies and research serve as a basis for determining the existence and characteristics of this subgroup. Three females; two in their early twenties, and one in her early fifties, have been chosen to undergo detailed analysis about their eating practices. These women were chosen based on preliminary observation of eating styles. Comparison of the case studies helps to determine how the attitudes and behaviors of the subgroup manifest themselves.

Board 10 COMPARATIVE GENOTOXICITY OF UV IRRADIATON, MITOMYCIN C, AND CISPLATIN IN WILD-TYPE AND DNA REPAIR DEFECTIVE MUTANTS OF *ESCHERICHIA COLI*. Kimberly L. Keller, Melissa A. Donaho, Doris J. Beck, Bowling Green State University, Dept of Biological Sciences, Bowling Green OH 43403. kkeller@bgnet.bgsu.edu

It is important to determine the cellular mechanisms responsible for the resistance of some cells to cisplatin, because of its extensive use in cancer chemotherapy. The SOS chromotest was developed as a bacterial assay in 1982 by Quillardet & Hofnung, based on the SOS response in bacteria, and was used here to assay DNA damage. In DNA, UV irradiation and cisplatin cause predominately intrastrand-crosslinks, whereas Mitomycin C (MMC) causes predominately interstrand-crosslinks; however, all these genotoxins cause many other types of DNA damage. *Escherichia coli* strains used in the SOS chromotest

have a fusion of *lacZ* (the gene for beta-galactosidase) with the *sifA* promoter. This construct allows the amount of DNA damage, which is modulated by the cell's ability for DNA repair, to be measured by assaying for beta-galactosidase. *E. coli* strains PQ30 (wildtype), PQ35 (*rfa*), PQ37 (*uvrA, rfa*), IN602 (*recB*), and IN237 (*recO*) were treated with various amounts of radiomimetric agents, allowed to grow for two hours, then beta-galactosidase assays were performed. The ability of the strains to survive was determined using plating experiments. The strains had different DNA repair abilities due to specific mutations, resulting in different levels of SOS induction and survival compared to the isogenic wildtype bacteria. After exposure to UV, MMC, or cisplatin, survival was decreased in *uvrA* and *recB* mutants, but not *recO* mutants. Mutations in the *recO* or *uvrA* gene caused a decrease in the SOS response after cisplatin, whereas mutations in the *recB* genes caused an increase. R values were > 90.

Board 11 STRAIN DIFFERENTIATION OF CLINICAL ISOLATES OF *PSEUDOMONAS AERUGINOSA* BY SEROTYPING, ANTIBIOTIC SUSCEPTIBILITY TESTING, AND BETA-GALACTOSIDASE PRODUCTION. Eric M. Proudfoot, Courtney Brickner, Roudabeh J. Jamasbi; 545 Sandralee Dr, Toledo OH 43612-3344. eric_proudfoot@yahoo.com

Over a one-year period, 261 clinical isolates were collected from a Northwest Ohio teaching hospital by standard microbiological techniques. The strains were serotyped by ELISA and / or slide agglutination techniques using specific monoclonal or polyclonal antibodies produced against the 17 out of 20 International Antigenic Typing System (IATS) of *P.aeruginosa*. From the 261 isolates, approximately 83% were typed by these antibodies. The O:11 serotype predominated in frequency (33%) followed by serotypes O:2 (8%), O:1 (6.5%) O:4 (6.5%), O:15 (6.1%), O:6 (5.7%), and O:3 (3.5%). Antibiotic susceptibility testing and beta-galactosidase production of these strains were determined to further differentiate the strains among the same serotype. No consistent susceptibility patterns were observed among and within the serotypes. However, it was noticed that resistance to one or more antibiotics increased over time in patients with re-infection and multiple isolation of *P.aeruginosa*. Approximately 61% (53 isolates) of serotype O:11 were found to possess beta-galactosidase enzyme capable of cleaving orthonitrophenol beta galactosidase (ONPG) substrate. It was also noted that some isolates of O:15 serotype (~30%) were also ONPG positive, a finding that has not been previously reported. No obvious connection between the site of infection and specific serotype has been detected. We concluded that the combination of several phenotypic characteristics is useful for the initial strain differentiation of *P.aeruginosa* in epidemiological study. Statistical analysis and genotyping studies are currently underway to further differentiate the strains with similar phenotypic characteristics.

Board 12 RELATIVE EFFECTS OF AGE, BODY WEIGHT, AND/OR DIET ON BLOOD GLUCOSE RESPONSE TO INSULIN. Kathryn E. Klingler, Kathryn T. Knecht, Ohio Northern University, 525 S. Main St, Ada OH 45810. k-klingler@onu.edu

Insulin sensitivity in white mice, as measured by blood glucose levels after insulin injection, may be affected by the age and weight of the animal. The purpose of these experiments was to distinguish the relative effects of age and body weight on insulin response, and further to determine if age and weight can affect blood glucose response to pharmacological agents. In these experiments, increased insulin response corresponded with increased length of fasting ($p<0.05$ for changes from 16 to 18, 18 to 20, and 20 to 24 hours, n=4 per group) and decreased with increasing age and body weight (5-13 weeks, 23-34 g; $p<0.05$, n=at least 4 per group). In 13-week-old mice that had been fed a calorie-restricted diet for 4 weeks to restrict weight gain, insulin responsiveness was more similar to that of 5 week-old animals of similar weight than to heavier 13-week-old animals fed *ad libitum* ($p<0.05$ between calorie-restricted and *ad lib* (34 g) and between *ad lib* and young animals, no difference between calorie-restricted and young mice, n=at least 7 per group). In 5-week-old mice, blood glucose levels of insulin-treated mice were elevated approximately 50% after ethanol (4 g/kg, p.o., $p<0.05$, n=at least 4 per group) vs. saline treatment. In 13-week-old mice, blood glucose levels of insulin-treated mice were 25% lower after ethanol (4 g/kg, p.o., $p < 0.05$, n=at least 4 per group) than after saline treatment. Calorie restriction in 13-week-old mice did not restore the hyperglycemic response of ethanol which occurred in young mice (n=at least 7 per group). The difference between young and old mice will be further studied with the oral antihyperglycemic agent metformin in the presence and absence of insulin. It is hypothesized that older, heavier white mice, who model the insulin unresponsiveness characteristic of type 2 diabetes, will respond more profoundly to this drug than young mice, and that this drug will attenuate the hyperglycemic response of ethanol by increasing insulin response.

Board 13 POSSIBLE MECHANISMS OF ETHANOL-INDUCED INCREASES IN BLOOD GLUCOSE IN YOUNG WHITE MICE. Stephanie A. Zank, Kathryn T. Knecht. Ohio Northern University, 525 S. Main St, Ada OH 45810. s-zank@onu.edu

Diabetics are counseled against drinking because alcohol could complicate blood sugar regulation. Previous experiments in mice found that young white mice (5 weeks old) were more sensitive to insulin challenge than older mice (9-13 weeks old), and that blood glucose in young but not mature mice was increased by ethanol prior to insulin challenge. Possible reasons for the ethanol-induced blood sugar increase in young mice include the physiological stress of ethanol, the calorie contribution of ethanol, the biochemical contribution of ethanol, the biochemical consequences of ethanol metabolism, or ethanol-induced CNS depression. In these experiments, mice (4-5 per group) were treated prior to insulin challenge with noise stress (tapping on cages and gentle handling for 15 minutes prior to insulin dosing and blood sampling), ethanol (4g/kg), isocaloric sucrose (7g/kg), 1-butyl alcohol (451 mg/kg; rapidly metabolized), or t-butyl alcohol (2000 mg/kg; slowly metabolized). A three-fold increase in blood glucose ($p<0.05$, Student's t-test) was detected with t-butyl alcohol vs. saline prior to insulin treatment, concurrent with severe CNS depression as shown by loss of consciousness. Stress and sucrose did increase blood glucose (statistically significant for only one stress timepoint), but the time course of these effects did not match effects seen with ethanol. t-Butyl alcohol prior to saline did not increase blood glucose.

Board 14 PROGRESS TOWARD THE SYNTHESIS OF 6-SUBSTITUTED IMIDAZO[2,1-*b*]THIAZOLES RELATED TO LEVAMISOLE. Joumana Aouad and Jeffrey J. Christoff, Ohio Northern University, College of Pharmacy, Ada OH 45810. j-aouad@onu.edu

Levamisole (Ergamisol©) is an immunorestorative agent currently recommended as adjunct therapy with 5-fluorouracil as standard treatment for patients with stage III colon cancer. Levamisole is considered to have negligible immunostimulant effects in individuals with properly functioning immune systems and immunorestorative effects in immunocompromised patients. Several plausible hypotheses for Levamisole's mechanism of action have been proposed, however, studies that critically evaluate these hypotheses are unable to substantiate these claims. The goal of this project is to identify substitutions at position 6 of the imidazo[2,1-*b*]thiazole nucleus that influence immunorestorative activity. The preparation of highly potent 6-substituted derivatives is necessary for the elucidation of Levamisole's mechanism of action. Levamisole facilitates the response of an inadequate immune system. Such activities are modulated by cytokines, and Levamisole's action may mimic an endogenous protein. Our target compounds are based on naturally occurring amino acids. We are replacing the phenyl substitution of Levamisole with a 3-indolylmethyl, benzyl, isobutyl, or isopropyl group and expect increased potency. The synthetic pathways are initiated with conversion of the amino acid methyl esters to their ethanolamides. Reduction to the corresponding diamines followed by sequential cyclization with carbon disulfide and 6N hydrochloric acid produces the heterocyclic ring system. In vitro screening will be performed with mitogen-induced lymphoproliferative assays utilizing donated human blood. Funding was provided by the American Foundation for Pharmaceutical Education and The Burroughs Wellcome Fund.

Board 15 A HISTOLOGICAL EVALUATION OF LUNG CANCERS BY MEANS OF HIGH-RESOLUTION LIGHT MICROSCOPY, IMMUNOMICROSCOPY, AND ELECTRON MICROSCOPY. Shana L. Ryan and David L. Mason, Wittenberg University, Springfield, OH 45501. dmason@wittenberg.edu

Our goal for this project was to evaluate lung cancers for cellular and histological features that can help with their identification. Tissues from several hundred patients with lung cancer evaluated at Community Hospital, Springfield, Ohio, were fixed for light and electron microscopy, embedded in plastic, sectioned, stained, and viewed under the light and electron microscopes. In addition, selected cellular markers helpful for specific identification were immunostained by the application of primary antibodies conjugated to peroxidase. The following types of lung cancer were studied by these techniques: Squamous Cell Carcinoma, Adenocarcinoma, Large Cell Carcinoma,Giant Cell Carcinoma, Small Cell Carcinoma (Oat Cell), Bronchioloalveolar Carcinoma, Carcinoid, and Mesothelioma. The results of our studies revealed a number of cellular, subcellular, and immunodetectable features that are helpful for determining each type of lung cancer. These include the identification of desmosomes, keratin, intracellular canaliculi with microvilli, neurosecretory granules, and Clara cell granules by electron microscopy; keratin, carcinoembryonic antigen (CEA), epithelial membrane bound antigen (EMA), chromogranin, bombisen, and neuronspecific enolase (NSE) by high resolution immunomicrocopy. The photographs presented on our poster highlight these features relating to each specific type of lung cancer.

Board 16 DEFEROXAMINE IMPROVES CARDIAC FUNCTION AFTER TWENTY-MINUTE ISCHEMIA. Rachel A. Chorba and Seth Bradford; (Daniel L. Ely, University of Akron; Cathleen M. Jenkins) Cuyahoga Community College; 11000 W. Pleasant Valley Rd. Parma OH 44130. Cathleen.jenkins@tri-c.cc.oh.us

It is well documented that there is the formation of free radicals following short-term ischemia in the heart. Free radicals such s the hydroxyl radical and peroxynitrate radical appear to contribute to the irreversible tissue damage seen following reperfusion. Deferoxamine (DFR), an iron chelator, has been shown to reduce free radical formation and ultimately maintain normal heart function during 24 hour *in vitro* heart preservation. It is the objective of this study to determine the effectiveness of DFR in reducing heart damage in rats after twenty minutes of global ischemia, which simulates a heart attack. The treatment group of rats will receive the DFR (0.05-mM DFR) in the drinking water for one week, while the control group will be kept on regular drinking water. (N=6 to 8 for both.) The isolated hearts are then perfused using the Langendorff technique both before and after a twenty-minute ischemia. Cardiac function will be determined by measuring the following: coronary perfusion flow, left ventricular systolic pressure, and left ventricular diastolic pressure. Ischemia is being accomplished by stopping the flow of the Kreb's solution for twenty minutes, stopping the flow of oxygen and essential nutrients provided by the solution. Measuring the solution passing through the heart, in the course of a minute monitors the coronary perfusion flow. A balloon is placed in the left ventricle and filled at the measurements of 0.05ml, 0.10ml, and 0.15ml, to record different diastolic and systolic pressures. Results will be analyzed for significance using the Student t. test and expressed as mean value +/- SEM. It is expected that deferoxamine administered before coronary ischemia will improve coronary function and reduce heart damage as compared to hearts without DFR.

Board 17 EQUAL OPPORTUNITY TO ACQUIRE NEW KNOWLEDGE. Dionna Stewart, Debbi Broughton, (Joseph F. Fagan, Ph.D., Case Western Reserve University and Cynthia R. Holland, Cuyahoga Community College), Cuyahoga Community College, 11000 Pleasant Valley Rd, Parma OH 44130. Cindy.Holland@tri-c.cc.oh.us

Conventional IQ tests are based on how much a person knows. But how much a person knows, depends on how well a person thinks as well as on what a person has experienced. Thus, experience always plays a role in estimates of IQ. For example, children born before or after a particular date to enter school, vary in IQ. People of different birth orders vary in IQ. All of these differences in IQ have to do with differences in experience not to actual differences in thinking or intelligence. Different racial groups vary in IQ. They also vary in experience. In the present study, 100 students, whites and blacks, were tested for their knowledge of vocabulary, on a standard IQ test. Prior to testing, all participants received training on the meaning of half of the words on the test. Thus, each racial group had an equal opportunity to learn half the words. For words that were not trained, the whites knew more than the blacks, a standard finding. But, for equally trained words, blacks and whites were equal in knowledge. Results indicate that IQ differences between blacks and whites have to do with experience. Blacks and whites have had different experiences, as have people of different birth orders or people whose birth dates put them in one grade or another in school. Results of the present study dispel any notion of genetic differences in intelligence between races. They indicate that standard IQ tests are culturally biased and, in many cases, are an inappropriate measure of a person's capability.

Board 19 WHAT GOES INTO MUSICAL ABILITY? Rhea McKinley (Douglas Detterman, Ph.D., Joanne Ruthsatz, Case Western Reserve University and Cynthia R. Holland, Ph.D., Cuyahoga Community College), Cuyahoga Community College, 11000 Pleasant Valley Rd, Parma OH 44130. Cindy.Holland@tri-c.cc.oh.us

400 participants were recruited from two Cleveland area high schools, the Cleveland Institute of Music, and from Case Western Reserve University. Participants were administered three measures, a standard IQ test, a test of innate musical ability, and an assessment of practice time. The outcome variable was the participant's rank in the orchestra or band that they performed in. A regression analysis was performed and results indicate that all three of the measured variables were predictive of the participants musical ability as indicated by their rank in the band or orchestra. Each variable showed significant contribution to musical ability and the order of importance was IQ, innate musical ability and then practice.

Board 20 TO FORGIVE OR NOT TO FORGIVE. Trinidad Morales (Roy Baumeister, Ph.D., Julie Exline, Ph.D., Case Western Reserve University and Cynthia R. Holland, Ph.D., Cuyahoga Community College), Cuyahoga Community College, 11000 Pleasant Valley Rd, Parma Ohio 44130. Cindy.Holland@tri-c.cc.oh.us

The project focuses on the topics of forgiveness and repentance, particularly on their facilitators and barriers. The purpose of the project is to determine what factors impact on a victim's willingness to forgive. A few of the factors under consideration are the closeness of the relationship between the victim and the transgressor, and whether or not the transgressor admits guilt and asks for forgiveness. The work involves carefully reading narratives and open-ended questions of approximately 50 undergraduate participants. The investigators will be seeking out patterns and categories of factors which impact upon a victim's willingness to forgive their transgressor. There will be qualitative coding of responses into those categories. A series of analyses will then be run on these data. Graphs will then be made to show comparisons among the categories and the possible effects of the categories on forgiveness.

Board 21 EXPLORING DIFFERENCES BETWEEN TRADITIONAL AND ALTERNATIVE WORK ARRANGEMENTS. Heather N. Odle (Dr. Jeff Stanton), Bowling Green State University, Psychology Dept, 530 Manville Ave., Bowling Green OH 43402. hnicole@bgnet.bgsu.edu

Recent reports show the growing increase in temporary help and part-time positions. Prior research has compiled a mass of contradictory findings. The present research is an attempt to understand the issues surrounding full-time versus part-time employees as well as permanent versus temporary employees in terms of job satisfaction, commitment, and stress. Data was utilized from three general samples of workers. Sample 1 (N=120) was obtained through direct canvassing of businesses, and had a response rate of nearly 100%. Sample 2 (N=310) had a response rate varying by organizations from 22% to 100%. Sample 3 (N=632) had a response rate of 54%. Both sample 2 and sample 3 were obtained through mail in surveys. In sample 1, temporary workers were found to have significantly lower job commitment than permanent. We found significantly higher satisfaction with supervision, based on the Supervision scale of the Job Descriptive Index, in part-time than full-time in sample 2. Sample 3 also found higher satisfaction with supervision among part-time than full-time, as well as significant differences in stress. The Pressure and Threat sub-scales of the Stress-in-General scale showed full-time were more stressed than part-time using a t-test for equal variances. Although expected differences were found, only a few were significant. Commitment was found to be higher among permanent than temporary workers. Differences in job satisfaction between full-time and part-time were insignificant. However, there was more satisfaction with supervision among part-time than full-time, and supervision satisfaction correlates with general satisfaction. Lower stress levels were also found among part-time than full-time. These findings show the need for future research, but they also illustrate the importance of being sensitive to different perceptions and reactions to the work place dependant on permanent, temporary, full- and part-time statuses.

Board 23 THE EFFECTS OF LIGHT EXPOSURE ON THE EXPRESSIVITY OF THE GENE FOR PIEBALD COAT COLOR IN HOUSE MICE. Emalie M Carson, Advisor, Dr. Rema Suniga, Ohio Northern University, Dept of Biological Sciences, Ada OH 45810. e-carson1@onu.edu

When a phenotype of a specific genotype varies from individual to individual, it is said to exhibit variable expressivity. One example of this phenomenon is the piebald spotting pattern observable in the coat color of *Mus musculus*. The spotting pattern is caused by the recessive *s* allele on Chromosome 14 of the mouse. Though the exact cause of variance in the degree of expression is unknown, it is known that environmental and genetic factors affect the spotting pattern. This experiment was designed to determine whether variations to light exposure during gestation had an effect on the coat color of the offspring. Ten pregnant females of the *ss* genotype were divided into five dark/light exposure groups and exposed to different time spans and wavelengths of light as follows: 1/23 hours, 12/12 hours, 23/1 hour, 23/1 hour ultraviolet, and 23/1 hour infrared. Twenty-eight days postpartum, the spotting patterns of the offspring were recorded according to location and size. These patterns were then recorded as a percentage of white fur to total fur: 1/23 hours – 17%, 12/12 hours – 13%, 23/1 hour UV – 15%, and 23/1 hour IR – 15%. Statistical analysis using ANOVA and the Post-hoc Scheffe's test (α=0.05) indicated that only the 1/23 hour and 12/12 hour groups were significantly different from each other. This indicates that pigmentation differences result from variations in exposure to regular light.

Board 24 NEUROMODULATORS AND AGGRESSION IN CRAYFISH, ORCONECTES RUSTICUS: DEPLETION OF SEROTONIN BY 5, 7 DIHYDROXYTRYPTAMINE. Jules B. Panksepp and Robert Huber. Bowling Green State University, Dept of Biological Sciences and J. P. Scott Center for Neuroscience, Mind and Behavior, Bowling Green OH 43403. julesp@caspar.bgsu.edu

Crayfish offer behavioral neuroscientists a model system for studying how specific physiological axes affect different components of behavior. Short-term infusions of serotonin (5-HT) reverse the likelihood of a previously subordinate crayfish to retreat from agonistic encounters. The present study examined the particular behavioral effects resulting from long-term serotonin depletions in the crayfish nervous system. We hypothesized that such a depletion should decrease levels of aggression. The neurotoxic molecule 5,7 dihydroxytryptamine (5,7-DHT) was loaded into silastica tubing and implanted into the thoracic tissue of socially isolated crayfish. After a recovery period, components of aggressive behavior (intensity, duration, escalation, who initiates/retreats) were compared between treatment and control animals when fighting size-matched opponents. Following the behavioral experiments, effective depletion of central 5-HT stores was confirmed using HPLC with electrochemical detection. Surprisingly, no behavioral deficits were detected as a result of such depletions. As depleted serotonergic neurons retain functional membrane properties, it is possible that targeted 5-HT cells may be using 5,7-DHT as an agonist in place of 5-HT. New avenues of interpretation may need to be considered by researchers using 5,7-DHT in invertebrate systems.

Board 25 HUNGER AND PRESENCE OF FOOD ITEMS INFLUENCE FIGHTING STRATEGIES IN CRAYFISH, *ORCONECTES RUSTICUS*. Adam M. Stocker and Robert Huber, J.P. Scott Center for Neuroscience, Mind and Behavior, and Bowling Green State University, Dept of Biological Sciences, Bowling Green OH 43403. amstock@bgnet.bgsu.edu.

Crayfish chelae are formidable weapons employed in fights among conspecifics. Individuals reduce the risks associated with extensive claw use by slowly increasing the intensity of a contest with an escalating sequence of stereotyped behavior patterns. Resorting to the rapid use of claws and unrestrained combat without prior assessment of the opponent's fighting potential thus carries great perils. We believe that hungry animals should take greater risks to feed. Similarly, individuals should be more daring when a desired resource is at stake. The goal of this study was to test these hypotheses by examining the differences in fighting strategies between hungry and satiated individuals in the presence or absence of a chemical food cue. Individual decisions for initiating encounters, escalating to higher intensities, retaliating, or finally retreating from an interaction, were compared within a 2x2 factorial design. In agreement with our hypotheses, hungry crayfish escalated more rapidly than satiated individuals. Our discussion focuses on the complex trade-offs between increased risks of injury, appetitive states, and increased opportunities for resource access.

Board 26 THE NEUROPEPTIDE PROCTOLIN INFLUENCES AGONISTIC BEHAVIOR IN CRAYFISH, *ORCONECTES RUSTICUS*.–Sarah Tuttle and Robert Huber, J.P. Scott Center for Neuroscience, Mind & Behavior, and Bowling Green State University, Dept of Biological Sciences, Bowling Green OH 43403. tutts@bgnet.bgsu.edu

Aggressive interactions in crayfish feature escalating sequences of stereotyped displays and fighting acts, allowing us to characterize this behavior in quantitative terms. In previous work our lab has demonstrated that the neuromodulatory monoamine serotonin greatly enhances aggressive tendencies in crayfish and lobsters. Proctolin, a putative neurohormone with unknown behavioral functions, is localized mainly in the pericardial organ, it has been shown to excite the swimmeret system, and to induce cardiac sac activity. As it generally co-localizes in serotonergic neurons an involvement in the neurochemistry of aggression is thus a distinct possibility. In this study we infused small amounts of this neuropeptide into the hemolymph of freely-moving crayfish using fine-bore fused silica canulas and then characterized the resulting behavioral effects. Within minutes of the start of the infusion, proctolin treated animals began to behave differently. They were less likely to participate in an interaction, very likely to retreat from advancing opponents, often

performed a series of unprovoked tailflips, and eventually assumed a subordinate status. In conclusion, our data are most consistent with proctolin fostering the expression of an underlying, non-specific fear component.

Board 27 QUANTITATIVE ANALYSIS OF CNS AMINE LEVELS IN CRAYFISH, *ORCONECTES RUSTICUS*. Zhaoxia Yue, Jules Panksepp and Robert Huber, J.P. Scott Center for Neuroscience, Mind & Behavior, and Bowling Green State University, Dept of Biological Sciences, Bowling Green OH 43403. zyue@bgnet.bgsu.edu.
Neuromodulatory monoamines, such as serotonin and dopamine, play important roles in the behavior of most animals. In crayfish the infusion of serotonin greatly enhances aggressive tendencies. Much less is known, however, about the extent to which amine neurochemistry is altered by behavioral contexts, such as dominance. Although amine distributions have been documented in the nervous system of crayfish using immunocytochemical methods, the exploration of such links requires a quantitative determination of amine levels. As a first step, we have adapted and optimized methods for HPLC with electrochemical detection for crustacean tissues. In the present paper, we use this system to explore the scaling of aminergic neurochemistry during the growth of crayfish. With a detection limit of < 2 pg of substance, we are able to measure the amine content of individual ganglia. In this study, male crayfish (5 – 25 g bodyweight) were dissected and the central nervous system was analyzed in 4 sections, namely the brain, the combined sub- and circum-esphageal ganglia, thoracic ganglia, and abdominal ganglia. Our preliminary results show that CNS amine levels are similar over a large range of body sizes.

Board 28 DIFFERENCES IN FIGHT STRATEGIES BETWEEN SMALL AND LARGE CRAYFISH, *ORCONECTES RUSTICUS* Lisa Schroeder and Robert Huber, J.P. Scott, Bowling Green State University, Center for Neuroscience, Mind & Behavior and Dept of Biological Sciences, Bowling Green OH 43403. schroed@caspar.bgsu.edu
Size-matched pairs of crayfish readily engage in agonistic encounters. Interactions increase in intensity until one individual withdraws. In such escalating fights the risk of injury rises as individuals begin to make unrestrained use of their potentially lethal weaponry. The growth of the claws greatly outpaces that of the rest of the body during normal development, and weapons should thus play a disproportionately greater role in fights between larger individuals compared to smaller ones. To examine this hypothesis, we analyzed the fight characteristics and fighting strategies in either small or large size-matched pairs of crayfish. Specifically, this study compared the number of interactions, their duration, maximum intensity, and rate of escalation in pairs either weighting 1-2.6 or 14-24 grams in an experimental arena scaled to the size of the animals. Fighting in small pairs was characterized by more interactions of shorter duration than between larger individuals. In agreement with our model, small crayfish were less hesitant to escalate quickly than larger individuals.

Board 29 MILLIMETER-WAVE ROTATIONAL SPECTRA OF SMALL ASYMMETRIC MOLECULES. Douglas T. Petkie, Jennifer L. Gottfried, Jennifer L. Powell, Ohio Northern University, Dept of Physics, Ada OH 45810. d-petkie@onu.edu
The rotational spectra of many small molecules found in the atmosphere have peak absorption in the millimeter-wave region. Based on these spectra, remote-sensing techniques can retrieve such information as molecular abundance, temperature and pressure. These techniques rely on accurate laboratory measurements and predictions, which is the focus of this research. The spectra of several molecules were recorded with the Fast-Scan Submillimeter Spectroscopy Technique (FASSST) that allows large spectral scans (10–40 GHz) to be recorded in seconds. This research involved assigning and fitting the rotational spectra of several thermally populated vibrational states of deuterated nitric acid (DNO_3), hydrogen peroxide (HOOH), and nitric acid (HNO_3) to distortable asymmetric rotor models. For DNO_3, the rotational spectra for the ground state, v_6, v_7, v_8, v_9, and $2v_9$ vibrational states in the 120–180 GHz region was assigned and fitted, involving approximately 600 transitions. A unique set of spectroscopic parameters, rotational and centrifugal distortional constants, was determined for each vibrational state. These fitted parameters reproduce the measured spectra to the experimental accuracy of 100 kHz, producing a reduced root-mean-square deviation near one. This demonstrates the effectiveness of the model. The parameters, approximately 10 for each vibrational state, accurately predict the rotational spectrum from the microwave to the far-infrared, totaling thousands of transitions. Only tentative assignments have been made for the v_6 vibrational state of HOOH and the v_3/v_4 interacting states of HNO_3. The analysis of these vibrational states is complicated due to significant interactions with other vibrational states that must be taken into account.

Board 30 BOUND TO BE DIFFICULT: MAPPING STRUCTURAL CHANGES IN HEMOCYANIN SUBUNIT II DUE TO OXYGEN BINDING. Ian W. Straffin (Lisa Unico PhD), Edinboro University, Cooper Science Hall, Edinboro PA 16444. Straffin@toolcity.net
Hemocyanin, the oxygen-transport protein found in horseshoe crabs, is similar to hemoglobin, but as an octa-hexamer, it is more complex and less well understood. Hemocyanin, like hemoglobin, is a multi-subunit molecule in which each subunit binds oxygen. Both hemocyanin and hemoglobin display positive cooperativity and allosterics in oxygen binding. We are studying the 628 amino acid subunit II. Allosteric effectors are small molecules, or ions that can also bind specifically to the transport protein. Binding of an allosteric effector changes the ability of the transport protein to bind oxygen by altering the structure of the protein. In the case of subunit II, chloride ion is an allosteric effector. We are in the process of mapping the structure of this protein in the 'bound' state with chloride ion. Mapping is performed after first isolating and purifying the protein by ion exchange chromatograph and centrifugation. Chemical modification and specific proteolysis are part of this mapping process. In specific proteolysis, the purified protein is digested with specific proteases. In this case trypsin, which cleaves only on the c-terminal side of lysine and arginine residues, was used. Peptides of protein are then separated on an HPLC column, and identified. A chemical modifier, p-hydroxyphenlygloxal will be used to modify arginines in the folded protein. This renders these sites immune to trypsin digestion. Thus, changes in the peptide map can be used to identify which arginine residues have been modified, and thereby are accessible to the solvent.

Board 31 STRUCTURAL CHANGES IN HEMOCYANIN SUBUNIT II DUE TO OXYGEN BINDING. William F. McCalmont (Lisa Unico), Edinboro University, Cooper Science Hall, Edinboro PA 16444. williamm@velocity.net
Hemocyanin, the oxygen-transport protein found in horseshoe crabs, is similar to hemoglobin, but as an octa-hexamer, it is more complex and less well understood. Hemocyanin, like hemoglobin, is a multi-subunit molecule in which each subunit binds oxygen. Both hemocyanin and hemoglobin display positive cooperativity and allosterics in oxygen binding. We are studying the 628 amino acid subunit II. Allosteric effectors are small molecules, or ions that can also bind specifically to the transport protein. Binding of an allosteric effector changes the ability of the transport protein to bind oxygen by altering the structure of the protein. In the case of subunit II, chloride ion is an allosteric effector. We are in the process of mapping the structure of this protein in the 'bound' state with chloride ion. Mapping is performed after first isolating and purifying the protein by ion exchange chromatograph and centrifugation. Chemical modification and specific proteolysis are part of this mapping process. In specific proteolysis, the purified protein is digested with specific proteases. In this case chymotrypsin, which cleaves only on the carboxyl side of tryptophan, tyrosine, phenylalanine, leucine, and methionine residues was used. Peptides of protein are then separated on an HPLC column, and identified.

Board 33 INCREASING EFFICIENT PRODUCTION OF THIN FILM SOLAR CELLS WITH CIS AS AN ABSORBER LAYER BY ELECTRODEPOSITION. Jonathan E. Cowen; (Alysius Hepp, NASA Glenn Research Center, Stan Duraj, Cleveland State University and Cathleen M. Jenkins) Cuyahoga Community College, 11000 W. Pleasant Valley Rd, Parma OH 44130.
Currently, we are investigating a more efficient means of producing thin film photovoltaic devices via electrodeposition. Conversion efficiencies of 17.8% have been achieved for chemically vapor deposited copper indium diselenide (CIS) based solar cells. However, electrodeposition is a much less toxic and less expensive means of producing CIS based solar cells. We are currently producing pn junctions using a p-type layer of CIS deposited electrochemically and a n-type layer of cadmium sulfide by chemical bath deposition. It has been previously demonstrated that changing the deposition voltage can vary the copper to indium ratio. These alterations allow us to change the CIS semiconducting material from N-type to P-type.A series of thin films have been produced with deposition potentials ranging from −1.21V to −1.29V (vs. a saturated calomel electrode) in .02V increments. Copper indium diselenide films are deposited on a molybdenum substrate for 600 seconds using a solution consisting of 1mM $CuSO_4$, 10mM In $(SO_4)_3$, 5mM SeO_2, and 25mM Na-citrate. After electrodeposition, films are rinsed with deionized water and annealed at 600°C for 2 hours. Film compositions have been characterized using Energy Dispersive Spectroscopy. A cadmium sulfide films is deposited on top of the CIS layer from chemical bath consisting of 1mM $Cd(C_2H_3O_2)_2$, 10mM thiourea, and 1M NH_4OH. The temperature of the bath is maintained at 60°C; films are deposited for ten minutes. An evaporated aluminum grid will serve as the top contact for the cells. Completed cells will be characterized by current vs. voltage measurements.

Board 34 A STUDY OF GALAXY COLLISIONS. Jennifer J. Bohland, (Michael L. Fisher). Ohio Northern University, Dept of Physics, Ada OH 45810. m-fisher2@onu.edu
The morphology of elliptical, irregular and spiral galaxies has long been a source of discussion in the field of astronomy. Toomre and Toomre (1975) have shown that several interesting features can result from the interaction or collision of spiral galaxies. Other authors have also studied galaxy collisions using different methods for modeling the gravitational interactions. We have taken an existing galaxy interaction code, GALAXY, and created our own version to operate under Microsoft Windows using Microsoft Visual Basic. The original code used a single mass point to simulate the intruder galaxy and several mass points to simulate the target galaxy. Our new code adds several mass points to the intruder galaxy as well as simplifying the input of initial conditions. This improves the capability of the code as well as allowing easy modification of the initial conditions once an interesting effect is seen. Several tests of the new code and validation runs of our code with that of Toomre and Toomre are presented here.

Board 35 ACYLATION OF AROMATIC COMPOUNDS USING NITRILES AND ESTERS. Joseph G. Lisko and Colleen A. Fried, Hiram College, Dept of Chemistry, P.O. Box 67, Hiram OH 44234. liskojg@hiram.edu
Acylation of aromatic compounds traditionally involves the use of acid chlorides, which are both expensive and corrosive. Esters and nitriles would provide safer and cheaper alternatives as acylating agents. Nitriles have been previously found to be effective acylating agents (Adachi et al., *J. Am. Chem. Soc.*, 1978, *100(15)*, 4842-4852. and Hennion and Toussaint, *J. Am. Chem. Soc.*, 1940, *62*, 1145-1147.), however, esters, while less expensive have proven to be less effective. We sought to adapt the procedure developed by Houpis and company (*Tetrahedron Lett.* 1994, *35(37)*, 6811-6814) to the use of esters as acylating agents, and extend the reaction to arenes other than aniline. The

same general procedure was followed for all reactions. In an ice-cooled, 25-mL round-bottom flask, the arene was dissolved in 1,2-dichloroethane. Boron trichloride was added slowly followed by the dropwise-addition of the ester or nitrile. Finally, aluminum chloride was added, and the mixture was stirred while slowly heating to 135ºC. Products were analyzed by TLC, GC-MS, and IR. The developed synthetic method has proven to be versatile, producing aromatic ketones from a variety of arenes using esters and nitriles as acylating agents. Once further optimized this procedure would be applicable to the synthesis of quinoline alkaloids, many of which have shown anti-HIV activity.

Board 36 A STUDY OF CHAOTIC PLASMA BURSTS. William L. Theisen, Hanna L. Wagner, Ohio Northern University, Dept of Physics, Ada OH 45810. w-theisen@onu.edu
Large amplitude plasma bursts have been detected in many types of plasmas including the northern lights, laboratory plasmas, and the solar wind around the various planets. Plasma bursts generally occur in the regions where two different plasmas come into contact. The nonlinear process of plasma burst formation involves a stream of fast moving electrons that has been accelerated by the differences in the two plasmas. This electron stream interacts with the plasma giving rise to plasma bursts, plasma waves, and other nonlinear processes. Several argon plasmas were created in an aluminum chamber and used to produce the plasma bursts in the laboratory. A chaos data analyzer program using time-series analysis methods was used to determine if the bursts occurred randomly in time. It was found that the time-series probability distribution is not random and that a large number of bursts are separated by a short time interval.Further investigation reveals that a long time interval is typically followed by several shorter time intervals. The first burst is thought to serve as a 'nucleation' site for the bursts which rapidly follow. This is consistent with the concept of cavition formation in plasmas. The time-series of plasma bursts have also been plotted in the phase-plane. Structure in these plots has been observed implying quasi-periodic or chaotic data. These observations give strong evidence that these laboratory plasma bursts are not formed randomly in time and that the use of chaotic methods for the study of these plasma formations leads to a better understanding of plasma bursts in general.

Board 37 BEAD PILE SYSTEM AS A MODEL FOR SELF-ORGANIZED CRITICALITY. Hanna L. Wagner and Donald T. Jacobs, Ohio Northern University, Physics Dept, Ada OH 45810. h-wagner@onu.edu
In 1987, Bak, Tang, and Wiesenfeld introduced a new paradigm in the physics of large, complex, dynamical systems called Self-Organized Criticality. Common to many systems is the natural tendency to organize itself at a critical state resulting in characteristic fluctuations, which are observed in everything from earthquakes to the stock market. The fluctuations are expected to follow a power-law distribution where there is no simple causality. One system that has previously been used as a model for SOC is a sandpile. We experimentally investigated smooth glass beads forming a conical pile, where adding one bead at a time causes many small, and a few large, avalanches. The size distribution of avalanches was consistent with the predictions of Self-Organized Criticality. In particular, the number of avalanches of a given size was proportional to the size of the avalanche to the power (-1.47 ±0.09), which is close to the mean-field prediction of –1.40±0.03. This result was independent of the size or shape of the base of the pile. We were also able to determine the power spectral density, which exhibited a power-law with slope -1.80 ± 0.09 that was also independent of base size and shape. This research was conducted at The College of Wooster with support from NSF-REU grant DMR 9619406.

Board 38 COMPARATIVE ONTOGENY OF AGONISTIC BEHAVIOR AND AMINERGIC NEUROCHEMISTRY IN THE CRAYFISH *ORCONECTES RUSTICUS*. Angelica J. Pytel, Bowling Green State University, J.P. Scott Center for Neuroscience, Mind and Behavior and Department of Biological Sciences, Bowling Green, OH 43403. apytel@bgnet.bgsu.edu
The resolution of intra-specific conflict has received much attention in adult crayfish due to conspicuous and potentially lethal weaponry. However, surprisingly little is known about the occurrence of these behaviors during development. This study examines the fighting behavior of early juvenile stages and explores whether the emergence of different behavioral acts coincides with ontogenetic changes in amine neurochemistry. After hatching, larval crayfish remain attached to the swimmerets of their mother. Morphological and behavioral development was monitored with ventral side macro-video recordings of unrestrained, gravid females. The first two larval stages featured only rudimentary claws, which functioned mainly in holding onto the mother's pleopods. Immediate contact with others commonly lead to avoidance behaviors. Approximately one week after hatching (stage 3), larvae began to detach from the mother and move about freely. At this time offensive agonistic behaviors were first observed with stereotyped patterns emerging in stages. These included a common threat display (meral spread) and first hesitant uses of claws. Gradually, behaviors were added to the agonistic behavioral repertoire with succeeding molts. CNS levels for serotonin and dopamine were measured in these larval stages using HPLC-ED. Developmental changes of aggression and neurochemistry are characterized.

Poster Session
Pre-College Students
1:30-3:00 PM
Meyer Hall

Board 01 DOES THE LOCATION OF WATER SAMPLE COLLECTION IN A DENTAL CAST GRINDER AFFECT THE QUANTITY OF COLONY FORMING UNITS OF HETEROTROPHIC MESOPHILIC BACTERIA? Erin F. Schlegel, 1900 Atwood Terrace, Coshocton OH 43812. dschlegel@coshocton.com (Coshocton High School)
The objective of this study was to observe the impact water site source collection (in a single dental appliance) had on the resulting growth of microorganisms. Different points of distribution in old and new cast grinders were tested. It was predicted that decreasing tubing diameters (as evidenced by the 1/2 mm aerosol fitting) would increase bacterial colonization. Millipore samplers (nutrient medium 94% comparable to their R2A agar counterparts) were filled with eighteen milliliters of water from each of the following sites: control (city water supply), input, output, aerosol, and plaster trap. Residual chlorine was removed from water samples through the use of sodium thiosulfate tablets and collection proceedings were followed-up with a 96 hour incubation period at 23 degrees Centigrade. This process was repeated over the course of the three trials. Results indicated that the aerosol was the highest source for microbial contamination, apart from the slurry-laden plaster trap. The standard goal to which the data was compared was issued by the American Dental Association and calls for dental appliances to contain no more the 200 colony-forming-units of heterotrophic, aerobic mesophiles by the year 2000. However, as evidenced by this experiment, the majority of dental contamination may be due to thermophiles. In addition, the possibility of horizontal gene transfer and the option of organisms adapting to their environments to suit their needs makes us more aware of the possibility of infectious disease transmission than ever before.

Board 02 WILL ONE DRUG KILL ALL THE BUGS? Alex D. Hollanshead, 13645 County Hwy 108, Upper Sandusky OH 43351. carolsh@udata.com (Upper Sandusky High School)
Infections are often caused by more than one type of bacteria. In order to successfully treat these infections, it is necessary to determine what antibiotics to use. The recovery of the patient is dependent upon the proper selection of antibiotics that will destroy all the bacteria involved. The purpose of this experiment was to see if there are antibiotics on the market that can inhibit multiple strains of bacteria using only one antibiotic. In order to verify my hypothesis that some antibiotics are very specific and effective only for certain types of bacteria while others are broad spectrum and can treat multiple bacteria, five different strains of bacteria were challenged with nine different antibiotics. The antibiotics used in this experiment included Ampicillin, Bactrim/Septra, Cephalothin, Ciprofloxacin, Erythromycin, Ofloxacin, Penicillin, Trovafloxacin, and Vancomycin. The five types of bacteria included three gram negative bacilli: *Escherichia coli, Proteus mirabilis,* and *Pseudomonas aeruginosa* and two gram positive cocci: *Staphylococcus aureus* and *Enterococcus faecalis*. The Kirby - Bauer sensitivity method was used to obtain sensitivity patterns that were compared to standards in order to determine which antibiotics were effective against which bacteria. After performing five trials to verify my results, I concluded that three of the antibiotics proved to be specific for one or two specific bacteria. Six of the antibiotics were effective against a wider range of bacteria. Trovafloxacin, Ofloxacin, and Ciprofloxacin were effective against all of the bacterial strains tested. These results supported the original hypothesis. Some antibiotics are effective against multiple strains of bacteria. One drug may kill many bugs.

Board 03 THE EFFECT OF DIFFERENT PHYSICAL CHARACTERISTICS ON SINGLE IMAGE STEREOGRAMS William R. Forister, 2431 Merbrook Rd, Worthington OH 43235, forister@gateway.net (Perry Middle School)
The purpose of this experiment was to determine the effect of different physical characteristics upon the perception of single image stereograms (two-dimensional images which, when viewed correctly, appear three-dimensional). Research was also performed to see if the human eye would adapt to the stereograms. The hypothesis was as follows: the younger a subject is, the faster a stereogram can be perceived. Gender will have a minimal effect on perception time, corrective lenses will have a measurable effect on one's ability to perceive a stereogram. Finally, the time required to perceive a stereogram will improve as a subject views multiple stereograms in succession. Before testing, thirty subjects were categorized by gender, age and visual clarity. They were then timed as they viewed six different stereograms in succession. After testing the subjects, the data was organized into a data matrix. The data produced clear results; the twenty subjects between the ages of twenty to forty-five were the quickest in perceiving stereograms. The fifteen females were slightly faster in perceiving the stereograms than the fifteen males. The seventeen subjects using corrective lenses had slower perception times than the subjects not using corrective lenses. The time required to perceive the image improved as the subjects viewed successive stereograms. The data obtained allows me to conclude that age, gender and corrective lenses affect the speed at which a subject perceives a stereogram. When multiple stereograms are viewed in succession, the time required to perceive the stereographic image improves.

Board 04 COMPARISON OF HEIGHTS OF ANGEL FOOD CAKES MADE FROM FRESH AND PROCESSED EGG WHITES, Tricia M. Yerardi, 124 Rinkliff Ln, Chillicothe OH 45601-8469. tricia_yerardi@hotmail.com (Unioto High School)

The egg industry has tried innovative ways to make eggs safer with a prolonged shelf life. This has included processing egg whites into dried, liquid, and frozen products. This study explored if these products were equivalent substitutes to fresh egg whites when preparing angel food cakes and if humidity affected the cakes height and texture. Hypotheses were: (1) processed egg white products would produce angel food cakes that were denser in texture and shorter in height; (2) all angel food cakes would be denser in texture and shorter in height when prepared on a humid day, (3) commercial-mix angel food cakes would be higher in height and less dense regardless of humidity. Each egg white product was utilized in the same recipe by substituting fresh egg whites for its equivalency stated on the specific product label. A total of 10 cakes were baked. Five cakes were baked when relative humidity was 66 percent and five cakes were baked when relative humidity was 92 percent. A commercial-mix angel food cake was prepared for comparison on both days. The results found: (1) angel food cakes prepared with processed egg white products were shorter in height when compared to height of fresh egg angel cake of 7.25 inches. The cake prepared with dried product was 7 inches; cake prepared with liquid product was 4 inches, and cake prepared with liquid product was 6 inches, (2) during high humidity of 92 percent, all angel food cakes were shorter in height and denser. Cake prepared with dried product was 6.3 inches; cake prepared with liquid product was 4 inches; cake prepared with frozen product was 5.75 inches, and cake prepared with fresh egg white was 6.6 inches, (3) the commercial product, perhaps due to additives, was higher in height, less dense, and least affected by humidity with height of 8.5 inches on low humidity day (66%) and 8.3 inches on high humidity day (92%). When considering the potential safety hazards of fresh eggs and additives in the commercial mix, a wise alternative to fresh egg whites when preparing angel food cakes may be the use of a dried egg white product.

Board 05 EFFECT OF CYTOKINES ON THE ADHERENCE OF STREPTOCOCCUS PNEUMONIAE TO CHINCHILLA TRACHEAL EPITHELIUM. Dan Li, 2992 Sudbury Rd, Upper Arlington OH 43221. cool_2001@hotmail.com (Upper Arlington High School)

The trachea whole organ perfusion technique was used to study the effect of tumor necrosis factor a (TNFα) and interleukin-1α (IL-1α) on the adherence of otitis media pathogen Streptococcus Pneumoniae (Spn) type 6A. The hypothesis being tested was that the adherence of Spn would increase under the effect of the cytokines. Tracheas were removed from 45 chinchillas and divided equally. One-half trachea was activated by incubation with 1-10 ng/ml of either TNFα or IL-1α prior to the addition of Spn 6A to the organ culture. Colony forming units (cfu) of Spn/millimeter trachea were determined for activated tracheas and controls. Dose response and kinetics data were then generated for each cytokine. The data indicate that both TNFα and IL-1α increase the adherence of Spn to the respiratory epithelium of this tubal organ. Next specific anti-cytokine antibodies were used in a neutralization study to determine if the increased adherence could be decrease. The data supports a significant decrease from the antibodies. Increased adherence by cytokines treatment may contribute to the pathogenesis Spn as seen in otitis media and other upper respiratory tract diseases.

Board 06 BACTERIAL CONTAMINATION OF COOKED AND UNCOOKED CHICKEN VS TIME. Christine L. Loza, 6337 Manteo Dr, Dublin OH 43016. loza-1@columbus.rr.com (Karrer Middle School)

Chicken is a food that many people eat almost weekly. But if not properly prepared, chicken can be harmful. This research project looked at the bacteria that grows on chicken to see how contaminated the chicken is that people eat. It was hypothesized that when ground chicken (including cooked chicken) is left out on the counter for different periods of time, then the chicken that has been left out on the counter for the longest amount of time will have the most bacterial growth. Ground chicken was placed on the kitchen counter for different time periods, then sampled using peptone water as a controlled way of testing the chicken for bacterial culture. Two trials were produced. Bacteria were cultured on agar in petri dishes and incubated for 48 hours. Colonies were then counted. Depending on the time the chicken spent on the counter and whether or not the sample was cooked, the number of colonies varied from two to one hundred thirty-five. The average amount of colonies grown for uncooked chicken was fifty-three and five-sixths colonies and the average for cooked chicken was nineteen and two-thirds colonies. The results supported the hypothesis. The two main factors that influenced this experiment were how long the chicken was left on the counter and whether the chicken was cooked. Cooking the chicken significantly lowered the bacteria count.

Board 07 THE BIOMECHANICS OF CHORDAL RUPTURE IN MITRAL VALVES. Kyra L. Sedransk, 15830 South Park Blvd, Shaker Heights OH 44120. JNKES1388@aol.com (Hathaway Brown School)

The heart's mitral valve governs unidirectional blood flow from left atrium to ventricle preventing backwash. Rupture of mitral valve chordae tendineae causes mitral valve insufficiency in mitral valve disease in humans. The mechanisms of chordal rupture are unknown. Normal mitral valves were studied to provide a basis of comparison for biomechanical analysis of rupture in diseased mitral valve chordae tendineae. It was hypothesized that normal chordae would rupture through yielding of collagen fibers that form the middle core. A total of 42 chordae from porcine mitral valves were classified by position: anterior marginal (16), anterior basal (7), posterior marginal (12), and posterior basal (7). Tissues were weighed, their dimensions measured; they were mechanically tested under uniaxial loading condition in an Instron. Following preconditioning, failure curves were obtained, and failure loads (g) recorded. Rupture characteristics were assessed under dissecting and polarized light microscopes. Marginal chordae weighed less and broke at lower failure loads than basal chordae. Marginal chordae tended to rupture close to but below the leaflet insertion (14/28) while basal chordae tore most frequently at the leaflet (7/14). The tear often extended halfway down the chordae; the torn collagen fibers gave the edge a "frayed" appearance. In normal mitral valves, pressure across the closed valve is balanced between numerous thin marginal chordae and relatively fewer thick basal chordae. In diseased mitral valves (e.g., myxomatous degeneration), abnormal leaflet geometry upsets chordal balance resulting in increased loads upon marginal chordae. Weakness observed in posterior marginal chordae corresponds to the high incidence of ruptures in this location.

Board 08 EVIDENCE FOR BACTERIA IN FAST FOOD RESTAURANT HAMBURGERS. Amy C. Schlegel, 1900 Atwood Terrace, Coshocton OH 43812. dschlegel@coshocton.com (Coshocton High School)

The objective of this study was to determine if ground beef hamburgers prepared at fast food restaurants would have comparable growth (in CFU's) to similarly processed meat sources. Four cooked hamburgers from Coshocton, Ohio fast food restaurants were tested (Burger King, Hardee's, McDonald's and Wendy's). In addition ground beef sources of Oscar Mayer all beef bologna, Food Club all beef franks, and fresh raw ground beef chuck from Big Bear grocery store were used as well. Samples were maintained at approximately 23 degrees Celsius prior to inoculation on agar plates. Each sample of 11 mg was diluted to a 1:1000 ratio with water and inoculated on trypticase soy agar plates four times. An additional trial was performed using trypticase soy agar plates with 5 % sheep's blood as the culture media. The results from 48 and 72 hours were then evaluated, on the criteria that the other counts were indiscriminately negligible or TNTC. Upon comparison with a commonly used recommendation for microbial contamination in milk of 200,000 CFU's/ml, Hardee's, Wendy's, Food Club and raw ground beef chuck were found to be the only samples with counts exceeding this limit. After contacting 17 sources (agricultural, microbiological, and state and local health agencies) it was determined that there is not a set standard for the bacterial colony counts for any ground beef that is consumed by the general public. It is suggested by this study that such a standard should be developed in the future.

Board 09 TOLERANCE OF TRANSGENIC ARABIDOPSIS PLANTS CONTAINING AN ANTI-AGING GENE TO ENVIRONMENTAL STRESSES. Anna K. VanToai, 4220 Baughman Grant, New Albany, Columbus OH 43054. avantoai@yahoo.com (New Albany High School) and Le Nguyen Huynh, Ohio State University.

The goal of the research is to determine if genetic transformation to incorporate an anti-aging gene can improve plant's tolerance to environmental stresses. Since environmental stresses cause plants to become senescent prematurely, it was hypothesized that transgenic plants containing the SAG12-*ipt* genes would be more tolerant to environmental stresses than wild-type plants. Specific tests were made on the tolerance of transgenic *Arabidopsis* plants containing the SAG12-*ipt* chimeric gene to drought, flooding, and salinity stresses. The SAG12 promoter is a senescence-induced promoter, which only turns on when the plants are undergoing senescence. The *ipt* gene codes for the enzyme isopentenyl phosphate synthase, the first step in the biosynthesis pathway of cytokinin, an anti-aging hormone. The SAG12-*ipt* chimeric gene is an autoregulated system that allows the production of the hormone only when the plants are undergoing senescence. Seeds of four SAG12-*ipt* transgenic *Arabidopsis* lines of the S_4 generation and of the wild type "Columbia" were germinated for one week. To test for flooding, drought and salt tolerance, the seedlings were submerged in sterile water, exposed to 30% PEG 8000 or 350 mM NaCl, respectively. After one week, the stress was removed and the plants were allowed to recover for one week. Stress tolerance was determined by the number of plants that survived and their biomass and chlorophyll content. All the four transgenic *Arabidopsis* plants containing the SAG12-*ipt* gene were more tolerant to drought, flooding and salinity stresses than wild- type plants. The results indicated that genetic transformation with an anti-aging gene could be used to improve the environmental stress tolerance in plants.

Board 10 EFFECTIVENESS OF OVER-THE-COUNTER ATHLETE FOOT TREATMENTS. Stephen J. Rybak, 356 St. Thomas Dr, Westerville OH 43081. Mford@cd.pvt.k12.oh.us (St. Paul School)

Athlete's foot, know as *Tinea pedis*, is caused by fungi including: *Trichophyton rubrum, Trichophyton mentagrophytes*, and *Epidermophyton floccosum*. These fungi are pathogenic and invade all parts of the body surface including hair and nails. Three chemicals that help fight athlete's foot are tonaflate, clotrimazole, and miconazole nitrate. These chemicals are found in the four over-the-counter (OTC) antifungal medicines Mycelex, Lotrimin, Tinactin, and Micatin Cream. Over-the-counter antifungal treatments were evaluated to determine which best eliminates athlete's foot fungus. I hypothesized Micatin Antifungal Cream, which has 2% Miconazole Nitrate, would work the best. To develop athlete's foot cultures, I measured doses of four antifungal creams that were then applied. The applications were repeated once on eight cultures and twice on four cultures. The cultures were examined approximately once a week to determine the effectiveness of each treatment. The hypothesis was supported. The Micatin Antifungal Cream not only worked the best, but worked the fastest. Micatin was the only OTC that showed a noticeable kill rate by the second week. However, by the final application all OTC products eliminated the fungus where the antifungal cream was placed.

Board 11 THE DEVELOPMENT OF A MICRO-SENSOR TO MONITOR SUFLUR DIOXIDE EMISSIONS. Ann Lai, 27030 Cedar Rd. Apt 404-2, Beachwood OH 44122. negalite@aol.com (Hathaway Brown School)

Acidic deposition is a threat to the environment, human health, and architecture. Its main contributor is sulfur dioxide emitted into the atmosphere from various sources, especially the industrial smokestacks. The purpose of this study is to develop micro-sensors to detect sulfur dioxide emission levels. There are four main types of sensor technology which can measure sulfur dioxide concentrations: spectrophotometric analyzers, conductometric sensors, piezoelectric crystal detectors, and interdigital capacitors (IDCs). However, all of these have many disadvantages. This study aims to develop and evaluate a sulfur dioxide detecting micro-sensor based on the recently developed three-electrode thick film technology with a working (platinum), a counter (platinum), and a reference (silver-silver-chloride) electrode which operates according to oxidation-reduction principles. Fifteen sensors were designed and developed using four electrode configurations in different sizes: rectangles, semi-circles, concentric circles, and concentric ellipses. All sensors were then tested for sensitivity and capability. For each sensor, an instrument inputted three cycles of power from –0.6V to 1.0V, and the generated current across the counter and working electrodes was measured for 0%, 1%, and 2% sulfur dioxide. Linear lines were fitted to the data for each voltage (0.5V, 0.6V, 0.7V, 0.8V) relating the percentage of sulfur dioxide and the current output; the results of the sensors were compared based on r, the curve-fitting coefficient, and the magnitude of the current output. The data indicated that: 1) the longer the length of adjacency between working and counter electrodes, the greater the current output and sensitivity; 2) as the size of the electrodes increases while the gap distances decreased, current output and sensitivity increase; 3) sulfur dioxide concentrations and current output have a direct and linear relationship. Currently, a micro-sensor system is being developed applying these conclusions and incorporating an actuator. This study has many applications as an economically feasible method to detect gaseous sulfur dioxide. Industrial applications include measuring sulfur dioxide emissions of industrial smokestacks, resulting in ability to effectively monitor pollution not only company by company, but also process by process.

Board 12 WATER USE EFFICIENCY UNDER DIFFERING CARBON DIOXIDE CONCENTRATIONS AND WATER AVAILABILITIES IN GLYCINE MAX. Helen Kathryn McClaugherty. 1623 S. Freedom Ave., Alliance OH 44601. mcclauhk@aol.com (Alliance High School)

Scenarios of global climate change include an increase in average temperature and atmospheric CO_2 concentrations and changes in patterns of precipitation. These changes may have profound implications for the productivity and geographical range of key agricultural crops, including *Glycine max* (soybeans). This study examined the influence of CO_2 concentrations and water availability on greenhouse grown *G. max*. Carbon assimilation was measured from V2 (second node) to R1 (beginning bloom) stages using a portable photosynthesis machine, the LI-COR 6400. The first hypothesis stated: water use efficiency will increase with decreasing water availability. The second hypothesis stated: water use efficiency will increase with increasing atmospheric CO_2 concentration. The third stated: atmospheric CO_2 concentrations and water availabilities will have an interactive influence on water use efficiency. There were three data test treatments, high water availability, medium water availability, and low water availability, containing 10 plants each. Over 100 carbon assimilation curves were run, approximately 30 curves per treatment. Water use efficiency was found to be much more dependent on carbon dioxide concentrations than on soil water availability and there was no significant interaction effect. If atmospheric CO_2 concentrations increase and the climate becomes warmer and drier, the beneficial effects of increased CO_2 concentrations on water use efficiency will counteract the negative effects of decrease water availability.

Board 13 THE EFFECT OF WIND AND TOUCH ON THE GROWTH OF ARABIDOPSIS. Rebecca F. Kemper, 3020 Trentwood Rd, Columbus OH 43221. Kemper.20@osu.edu (Watterson High School)

The effect of wind and touch treatments on Arabidopsis plants was observed. Hypotheses offered were: 1). Plants exposed to 12 hours of wind a day will be shorter than 1hour exposures and ten minute exposures. 2). Plants exposed to 10 minutes of touch will be shorter then plants exposed to 5 minutes and no wind/no touch (control) a day. On average the control will be the tallest. Forty-eight Arabidopsis plants were divided into two lots of twenty-four plants and was further divided into six treatment groups (including the control). Wind treatment groups were: Wind all day (W3), wind for an hour (W2), and wind for ten minutes a day (W1). Touch treatment groups include: touch for ten minutes (T2) and touch for five minutes a day (T1). A control group (C1) received no wind/no touch a day. Lights and a fan were set on a timer to run various times a day. Touching was done by hand. After the plants began to sprout I.D. numbers were randomly assigned to the plants, according to lot, touch, wind and time. The treatments of wind and touch were applied for twenty-four days. Results indicated the combined average height of: (1) wind all day 5.20cm; (2) 1 hour 5.21cm.; (3) ten minutes a day was 4.11cm.; (4) touching for ten minutes a day 5.13cm.;(5) five minutes was 5.48cm.; and(6) the control was 4.61cm. Plants with wind all day were the second tallest. The control yielded the second shortest height. These results do not support the hypotheses.

Board 14 COMPARING THE NUMBERS OF MACROINVERTEBRATES IN DEER CREEK NORTH AND SOUTH OF THE WILLIAMSPORT SEWAGE TREATMENT PLANT. Lauren D. Metzger, 6950 Hunsicker Rd, Williamsport OH 43164. curlybob_03@hotmail.com (Westfall High School)

This study attempted to analyze the water quality of Deer Creek near Williamsport, Ohio by investigating the macroinvertebrate population. The study compared the numbers of macroinvertebrates occurring at points north and south of the Williamsport Sewage Treatment Plant's effluent pipe. Because many macroinvertebrates are pollution-sensitive, decreased numbers of macroinvertebrates south of the effluent pipe could indicate problems with the effectiveness of the plant's pollution control systems. It was hypothesized that a lesser number of macroinvertebrates would be found south of the pipe, since water flowing from the pipe could create a less favorable environment for them. Riffles known to attract macroinvertebrates were located at points both north and south of the pipe. Procedures and materials for collecting macroinvertebrates at these points were consistent across three different trials. Data was recorded to include numbers and type of macroinvertebrates collected. The results showed 60 macroinvertebrates north (5 dobsonfly larva, 13 cranefly larva, 3 crayfish, 2 riffle beetles, 1 water penny, 4 caddisfly larva, 2 beetle larva, 23 clams, 2 pouch snails, 1 sowbug, 3 stonefly, 1 dragonfly nymph) and 15 south (1 cranefly larva, 3 clams, 1 sowbug, 5 stonefly, 1 blackfly larva, 1 dragonfly larva, 3 aquatic worms). Although the research hypothesis was supported, it could not be concluded that the lower numbers were a result of polluted water coming from the effluent pipe. One of the most pollution sensitive species, the stonefly larva, showed no significant decline south of the pipe. The lower numbers may have been due to a less favorable habitat due to site-specific fecal coliform or other point source contaminants. Replication studies should be made to control for these variables.

Board 15 THE EFFECTS OF WATER POLLUTION ON THE HEART RATE OF *DAPHNIA MAGNA*. Kelly M. Kaufman, (Annette Jerwers), 13853 Rd. J, Ottawa OH 45875. mkaufman@bright.net (Glandorf Elementary School)

Only three percent of the Earth's water is freshwater that is suitable for humans and most plants and animals to use. Keeping our freshwater clean and safe is vital to the survival of life on Earth. Sewage, fertilizers, pesticides, herbicides, landfills, acid rain, oil, and chemical pollution from manufacturing all create runoff and pollute our freshwater. *Daphnia magna* are small crustaceans common in freshwater in the United States. *Daphnia* were chosen for test subjects because they are transparent under a microscope and adapt quickly to their surroundings. What are the effects of water pollution on the heart rate of *Daphnia magna*? It was hypothesized that the heart rate of the *Daphnia* will slow down, or the *Daphnia* will die when placed into water mixed with pollutants. Eight substances that could potentially pollute water in the Ohio area were tested: potash, nitrogen, phosphorus, dry manure, liquid manure, Atrazine, liquid Tide, and a 1:32 oil:gas mixture used in motor boats and recreational water craft. A 1/125 (.8%) solution of each of these substances was made with water by volume, and *Daphnia* were placed in each solution, under a microscope, and watched for changes in their heart rate. The heart rate was checked twice with each trial and the tests were repeated, using a different *Daphnia* each time. *Daphnia* heart rates were definitely affected by water pollution, and the effect seems to be greater with herbicides, detergents, and the mixture of oil and gas. The fertilizers, both chemical and natural, that are used frequently on fields in the Ohio area, do not seem to have a profound effect on the short term heart rate of this organism.

Board 16 COMPUTATIONAL FLUID DYNAMICS FOR THRUST VECTORING PREDICTIONS. Michael E. Eriksen, 661 Yount Dr, Wright-Patterson AFB OH 45433. eriksen@mics.net (Dayton Christian High School)

The purpose of this experiment was to determine whether computational fluid dynamics (CFD) is effective and accurate in predicting the performance of a thrust vectoring nozzle. The goal was to see if CFD could replace a physical experiment. It was hypothesized that by using CFD, it would be possible to predict the effectiveness of different types of thrust vectoring nozzles. A computer model was designed to replicate an existing physical thrust vectoring test in which three variables were chosen - nozzle shape, length, and angle. Statistically, these factors were arranged in a full factorial combination to make twelve different nozzle types, each having a different combination of the three variables. A three-dimensional CFD model was then used to calculate the thrust vectoring force for each nozzle type. Individual factor effects were calculated and compared to the overall average effect. Although the results of the computer simulation followed the general pattern of the physical test, the vectored thrust values were consistently higher. The nozzle types with less turbulence in the physical test more closely matched the results from the computer test, since the CFD model did not include turbulence. In conclusion, the hypothesis was supported. CFD can be used to obtain a basic understanding of how a thrust vectoring nozzle will perform. If turbulence could be programmed into the CFD code, then the results would be more precise. However, with this degree of model complexity, CFD was useful for observing data trends and determining which factors had a positive influence on thrust vectoring performance.

Board 17 TRAFFIC SIGNAL OPTIMIZATION. Amanda R. Beach, 2652 Ridge Rd, Xenia OH 45385. beach00@excite.com (Carroll High School)

The purpose of this project was to determine if the use of traffic signal optimization software could help improve the efficiency of a local intersection. The hypothesis proposed is that, with the use of such software, improvements could be made to the traffic flow of the intersection Spinning Road and Linden Avenue in Dayton, Ohio. To obtain data for

calculations, a manual traffic count was performed between the hours of 6:15 a.m. and 6:15 p.m., on a Tuesday in early December, in order to ascertain the peak hour characteristics of the individual movements in the traffic flow. Next, using highway capacity software, the level of service was calculated with a grade of 'A' thru 'F', based on the average vehicular delay in of seconds. During morning peak, for an average weekday, the overall efficiency of the intersection was a C, but during both afternoon and evening peak periods, the intersection operated at level of service F, an unacceptable grade. Next, adjustments were proposed for cycle lengths, phasing, and geometric configurations of the intersection. The morning hours again received a level C grade, but with less delay time. In the afternoon, level of service was brought up to a C grade with less delay, and in the evening, the intersection was optimized to a grade of B, with less delay. Overall, the hypothesis was supported. The existing intersection configuration was quite inefficient and potential improvements could be identified with the assistance of the computer software. In conclusion, if these improvements were implemented, congestion and accompanying driver frustration would be decreased, optimizing intersection efficiency.

Board 18 THE EFFECTS OF GIBBERELLIC ACID ON WISCONSIN FAST PLANTS BASIC'S AND ROSETTE'S PEROXIDASE ACTIVITY. Marianne K Torontali, 2199 Barrington Rd, University Heights OH 44118. Chautauqua1@worldnet.att.net (Beaumont School)

Wisconsin Fast Plants are specially engineered plants that complete their life cycle in approximately 35 days. Gibberellic acid is a growth hormone that has a very large regulatory role in the plant's growth. Although gibberellic acid is found to be mostly helpful, it has been found to be harmful by decreasing the peroxidase activity, otherwise known as the plant's defense system. It was hypothesized that gibberellic acid will destroy peroxidase activity at a greater rate in the Basics (*Brassica rapa*) compared to the Rosette plants. The experiment included the controls: distilled water and a constant source of fluorescent light. After two weeks of growth, gibberellic acid was applied using one spray (per quad). This was done daily for one week. Afterward, they were left to grow for one week. Following that, they were taken to a lab, where they were analyzed. The peroxidase activity was analyzed by dot blots, which are constructed by using liquid plant extracts, nitrocellulose membrane, and four different standards. This established loss of peroxidase activity in the Basic (*Brassica rapa*) plants, but no loss o peroxidase activity in the Rosette plants. A gel test was performed by inserting the liquid plant extracts and the four different standards into an agarose gel to isolate the peroxidase isoenzymes. The plant extracts migrated through the gel dependent upon the amount of peroxidase isoenzymes present. In conclusion my hypothesis was supported. The Wisconsin Fast Plants Basic's (*Brassica rapa*) peroxidase activity was destroyed at a greater rate than the Rosette's due to the applied gibberellic acid.

Board 19 PUCK PLACEMENT AND STICK PATH EFFECT ON THE VELOCITY OF A HOCKEY SLAP SHOT. William C. Musat, 3516 Darlington NW, Canton OH 44708. Rider3516@aol.com (Pleasant View Middle School)

The slap shot is hockey's most dramatic shot. Although the slap shot lacks accuracy it is used in many game situations because of its ability to create high puck velocities. The high puck velocity comes from both the long-rapid swing of the stick, and the bending of the stick which "snaps" to give the puck additional speed. Developing a good slap shot technique requires a player to find a method for using the flex of the stick to increase the velocity of the puck. This investigation examines the best stick path and puck location for the author's slap shot. To assure consistency, a machine was designed and built to duplicate the authors swing. Using this machine the axis of rotation, speed, force, and stick grip were held constant during a series of over fifty tests, where as puck location and swing paths were varied. Puck velocities were measured using a radar gun. It was hypothesized that the greatest puck velocity would result from locating the puck several inches in front of the axis of rotation and striking the ground just before the puck. Results with the test machine showed that the greatest velocity results when the puck is located directly under the axis of rotation and the ground is struck 16.5 cm. before the puck. Applying these findings to the authors swing produced mixed results. Application of the recommended puck position proved to be of no help but use of the recommendation for stick path gave a fifteen- percent increase in puck velocity to 21 m/s.

Board 20 IDENTIFING COLLOIDS. Derek R. Free, 312 Emerald Ln, Chillicothe OH 45601. tayrae@bright.net (Paint Valley Junior High School)

A colloid is a substance consisting of ultramicroscopic particles uniformly dispersed through a second substance forming a solution. A colloid can take the form of a solid, liquid, or gas. A flashlight was used to shine through a small circular opening cut into a 9"x6" box containing three one quart jars filled with plain tap water. One teaspoon of salt was added to one jar of water, and one dropper of milk was added to the other. The third jar was left with plain tap water. With the light shinning into the darkened box, the colloidal particles could be seen with the naked eye suspended in the water containing the milk. The salt water was cloudy at first, but cleared, proving a non solution. A spectrophotometer is used to measure the density of particles within a solution. The weak milk solution was replaced with two percent milk because the spectrophotometer could not detect the small amount of colloids with one dropper per quart. The tap water was placed in a test tube and put into the spectrophotometer at 100 percent transmittance to provide a starting point. Second, the salt water was measured and a reading of 95 percent resulted. Next, the two percent milk was measured and provided a reading of only 58 percent transmittance. For reliability, this test was conducted five times with identical results. The results showed that milk is a colloid containing solution, and water and salt water are not. The experiment successfully identified colloids.

Board 21 EFFECTS OF "PLUS 100" IN RELATION TO FUEL LINE FREEZE UP IN JET FUEL (JP8). Thomas G. Howell, 8653 Taylorsville Rd; Huber Heights OH 45424. howelltg@aol.com (Wayne High School)

Military jet fuel is not acceptable when it is cloudy because the cloudiness indicates the presence of water suspended in the fuel and fuel line freeze ups could occur. Another problem that can occur involves masses of fuel, water, and icing inhibitor agglomerating in the fuel tanks to form two phases. The bottom layer of the fuel, when it is cloudy, is similar in texture to apple jelly. This "Apple Jelly" clogs the fuel coalescers on delivery trucks which then permits water to pass through rather than filtering it out. Since this "Apple Jelly" contains most of the icing inhibitor, there is little remaining in the fuel transferred to the jet. The purpose of this study is to examine the effect of "plus 100" on the efficiency of JP8 jet fuel. It was hypothesized that the JP8 plus 100 would not create additional water in the fuel and the range of temperatures for the creation of two phases ("Apple Jelly") in the delivery trucks would be high enough that it would only occur during extremely hot weather. The first stage of this study investigated the amounts of water created in JP8 fuel compared to the amounts of water created in the JP8 plus 100 fuel by adding a varied amount of water to each fuel and running them through a scaled down model of a fuel system. The fuel filter was replaced with a dye pad to measure the amount of water created in the fuel. The dye pad was then put into an Aqua Glow machine to measure the amounts of water in parts per million (ppm). These results support the first portion of the hypothesis by indicating that the JP8 plus 100 fuel actually created less water than the JP8 fuel without the "plus 100" additive. The additive contains the icing inhibitor 2-Butoxyethanol that does not mix well with the jet fuel and can yield multiple phases at certain concentrations and temperatures. The second stage of this study incorporated a phase diagram to illustrate when the two phases could occur with 2-Butoxyethanol in the additive. This was done by mixing different percents of 2-Butoxyethanol and water together and heating the mixture until it became cloudy. The temperature was measured and entered on a phase diagram. The results support the second portion of the hypothesis in that the range of temperatures in which the "Apple Jelly" could occur is high, specifically, between 45 and 125 degrees Celsius.

Board 22 TESTING THREE METHODS OF OIL SPILL CLEANUP. Dylan T. Jesse, 5481 Woodland Pl, Canfield OH, 44406. djesse@gateway.net (Canfield Middle School)

The objectives of this experiment were to compare three different methods for cleaning up aquatic oil spills and to determine which is the most effective. The method of absorption was expected to be the most effective. Equal amounts of used motor oil were added to three similar containers holding the same volume of water. The first method involved dispersion by the addition of a common liquid household detergent, [Dawn], to the slick. The second method involved digestion by the addition of an enzymatic septic tank treatment mixture, [Rid-X]. The third method involved absorption by placing a crushed clay compound, [Oil Dri], into a mesh container suspended into the slick. Visual observations discovered dispersion caused no elimination of the oil from the water's surface, rather, it lowered the surface tension on the water forcing the oil to the periphery of the container. The addition of the digestive compound caused clumping and sinking of the oil, leaving less surface pollutants. Absorption by dry crushed clay resulted in complete removal of the slick from the water's surface. The method of absorption of an aquatic oil spill using dry crushed clay was the most effective form of cleanup.

Board 24 W.O.W.- WATERSPOUTS ON WATER. David C. Kamm, 602 Cook Rd, New London OH 44851. makamm@accnorwalk.com. (New London Jr. High School)

Waterspouts form when cold and warm air meet over large bodies of water. Two waterspouts were seen on Lake Erie in July 1998. The objective of this project is to determine how air temperature affects waterspouts. The hypothesis is waterspouts will be stronger formations over hot air. A gallon milk jug was used by slapping the bottom to create airwaves directed at a lighted candle. The air inside was heated with a hair dryer and the experiment repeated. The observation was that the hot air was twice as powerful at one and two feet away from the candle. At 3 feet, the hot air was 3 times more powerful than the tepid air rings. Next, I used water in a test tube with a stopper and glass straw in the middle. I inverted it into a glass with water. I heated the test tube water for different times. The data revealed when 1/2 minute was added to a minutes heating, the amount of water pushed was just over 1 and 1/4 times greater. When the heating time was doubled, almost 4 1/2 times more water was pushed up into the tube at 97% faster. Results show heat added 3 times more air pressure and 4 1/2 times more pushing power in my experiments. The power behind the water that exploded up the test tube I was holding gave me an idea of what happens in waterspouts. The hotter the air becomes, the stronger the power of waterspouts.

Board 25 A COMPARATIVE STUDY OF THREE BRANDS OF MASTITIS PREVENTION PRODUCTS. Joshua M. Penhorwood, 27900 Newton Perkins Rd, West Mansfield OH 43358. Pwood02@yahoo.com (Benjamin Logan High School)

Mastitis cost the United States dairy farmers $2 to $4 billion dollars each year, which is why it is important to have a good, sound mastitis management program. The purpose of this project was to determine which of the three brands of mastitis prevention products (Bio-Dry, Dry-Clox and Quartermaster) most effectively prevented mastitis. Dry-Clox was expected to work the best. Somatic cell counts of each bovine were taken by a certified milk tester and recorded. Selected bovine at the end of their lactation were brought into the milking parlor and each bovines identification number was recorded. A total of 70 bovine were dried off over a seven month period. All bovines were milked as normal being sure to take out all milk. Each teat was then cleaned with an alcohol pad. The contents of the prepackaged syringe containing Bio-Dry, Dry-Clox or Quartermaster was injected into

each quarter. The teat duct was then sealed with stronghold teat sealant by dipping each teat into cup filled with sealant. 70 bovine were treated and 54 bovine freshened and began lactating 55-60 days after drying them off. After bovines began lactation the somatic cell count was taken by the certified milk tester and recorded. This was done throughout the bovines' entire lactation. Recorded somatic cell counts of 70 bovine before drying off and 54 after freshening. 17 bovine were treated with bio-dry, 45 treated with dry-clox, and 8 treated with Quartermaster. The somatic cell counts of each bovine were then looked at for the first three months of the following lactation for a somatic cell count that indicated mastitis (a somatic cell count over 750,000 indicated mastitis). Results show Bio-Dry with a 23% rate of mastitis among the bovine it was used to treat, Dry-Clox with a 21% rate of mastitis and Quartermaster with a 12.5% rate of mastitis, indicating that Quartermaster was the best treatment.

Board 26 THE RELATIONSHIP OF FILM SPEED AND SHUTTER SPEED IN CAMERAS. Katrina A. Nicholl, 315 S Detroit St, Bellefontaine, OH 43311-1744. soccerjock9@hotmail.com (Bellefontaine High School)

Faster film speeds generally allow faster shutter speeds. The camera will take pictures faster, therefore stopping the action. A Ricoh XR-3PM camera, Tamron 28 - 70 lens, Bogen tripod, Tiffin neutral density filters and 100, 200, 400, 800, speeds of Kodak film were used. The first experiment was performed along Main Street in Bellefontaine OH. Vehicles were monitored for constant speed, pictures were taken with each film speed at various apertures. Neutral density filters were used to absorb some light, causing the shutter speeds to be lower, therefore giving a better range of speeds. In the second experiment green water was poured from a two liter bottle, at a steady pace, into a bucket while pictures were taken at various shutter speeds. The third experiment was taking of pictures of water flowing over the spillway at Indian Lake, again at various shutter speeds. All data was recorded, speed of film, shutter speeds and if a filter was used. The film was taken to a professional lab to be processed. They were carefully compared to the negatives and labeled with exposure and film speed, then evaluated. As was expected, the faster film speeds enabled faster shutter speeds to stop the action of vehicles, water from the bottle, and water flowing over the spillway. Sports photographers should use the fastest speed film possible to stop action in the photograph.

Board 27 MOLARITIES OF HCL AND THEIR CONDUCIVE EFFECT ON THE CORROSION OF METALS. Walter Rice, 11133 Co. Rd. 1, Chesapeake OH 45619. (Chesapeake High School)

The hypothesis of this project was that under all conditions magnesium would corrode the most. Magnesium was chosen because it is an alkaline earth metal with two valence electrons. It was believed that because it was the easiest to compound with other elements that the reactivity would be varied the same as well. Every sample of metal was cut and massed to one gram then dipped in one of four molarities: six molar, three molar, one molar, and one-half molar. The metals were placed in the acid for ten seconds, and then the metals were washed, rinsed, dried and massed. The mass afterwards was recorded. The procedure was repeated with all metals: iron, zinc, lead, aluminum, and magnesium; and all molarities of acid. Zinc was found to have a discoloration after being exposed to the acid. This is probably from an outer coating being made or destroyed. Magnesium also had a discoloration and sizzled, bubbled, and gave off a weak moist gas. Iron showed a dissolving of rust after being in the acid. Aluminum had a lighter discoloration. Lead did not show much change after being placed in the acid. Zinc in the six molar acid dissolved to 96mg, in three molar it burned to 97mg, in the one molar acid zinc corroded to 98mg, and in the one-half zinc dissolved to 96mg. Iron corroded to 95mg in the six molar acid, in the three molar acid iron burned to 97mg, iron dissolved to 99mg in the one molar acid, and in the one-half molar acid it burned to 95mg. In the six molar acid aluminum corroded to 94mg, aluminum dissolved to 95mg in the three molar acid, in the one molar acid Al burned to 96mg, Al corroded to 98mg in the one-half molar acid. Lead corroded to 99mg in the six molar acid, in the three molar acid Pb dissolved to 98mg, Pb in the one molar acid burned to 99mg, and in the one-half molar solution Pb corroded to99mg. Magnesium in the six molar acid corroded to 93mg, in the three molar acid Mg dissolved to 98mg, in the one molar acid Mg burned to 97mg, and in the one-half molar acid Mg corroded to98mg. The hypothesis was rejected as the results revealed that the molarity of acid did affect all metals differently and not that magnesium corroded the most. This data was conclusive though considering that the whole sample could not be dispersed in the acid completely. Also, the time left in the acid was not always the same. The acids were used over and over and this in turn probably changed the molarities. Overall in hindsight I still believe my hypothesis would have been proven if there had not been so many outside variables.

Board 28 THE EFFECTS OF AIR AND WATER TEMPERATURE ON HURRICANES. Ashley E. Gibbs, 2207 Saddle Creek NE, North Canton OH 44721. AGibbs14@excite.com (Glen Oak High School)

A need to understand what environmental factors affect a hurricane's strength was identified. Hurricanes occur each year in the oceans and gulfs of the world. News broadcasts only talk about the size and category but never explain why the hurricanes grow larger and stronger. The goal obtained in the experiment was to determine what factors affected the strength of these storms. It was hypothesized that the water and air temperatures would affect the hurricane's strength, with water having the greatest impact. An accurate method to test the affect of water and air temperatures on a hurricane's strength was devised by constructing a box to visually observe the hurricane. The box was designed so the water and air temperatures could be controlled separately. Eight different air temperatures and four different water temperatures were used, holding one variable constant while testing the other. The visual observation was based on the organization and speed of rotation of the funnel. Higher water temperatures with lower air temperatures caused the funnel of the hurricane to become tighter and rotate faster than the opposite circumstance. The conclusion was reached that water temperatures affect the strength of a hurricane more than air temperatures. Visual observation was used to rate the strength of the hurricane. This experiment has since been run again using a wind velocity meter to more accurately rate the hurricane's strength. This was unsuccessful due to the lack of air movement to operate the wind velocity meter accurately.

Poster Session
Pre-College Students
3:00-4:30 PM
Meyer Hall

Board 01 WHAT SUBSTRATE IS THE BEST FOR GROWING OYSTER MUSHROOMS AT HOME? Sanjana Sundararajan, 8600 Copperview Dr, Dublin OH 43016. Pointyfeet@hotmail.com (Learning Unlimited Village Academy)

Home cultivation of the Oyster Mushroom (*Pleurotus ostreatus*), a popular edible mushroom, has gained popularity. There isn't much information regarding the best substrate for cultivation of Oyster Mushrooms at home. The purpose of this experiment was to find out the best substrate for growing Oyster Mushrooms at home. This was done by measuring the number, weight, and time of germination of Oyster Mushrooms in four substrates; coffee grounds, peat moss, shredded paper, and mushroom spawn. The hypothesis stated that the coffee grounds, because of its organic content, and mushroom spawn, because of the already grown mycelia in it, would be the best substrates. 150 grams of each substrate was inoculated with 150 grams of mushroom spawn. The experiment was done in duplicates. The substrates were put into pans and covered with a holed plastic sheet to maintain humidity. The pans were placed in random order so surroundings would not have any effect on growth. Substrates were sprayed everyday at the same time with 1/8 of a cup of water. Number, weight, and time of germination of mushrooms in each treatment was recorded. The hypothesis was partially supported. Mushroom spawn produced the most and biggest mushrooms in the shortest time. Coffee grounds grew no mushrooms. Mushroom spawn, shredded paper, and peat moss grew 2 mushrooms each. They weighed an average of 20g, 20, and 10g respectively. Time taken to grow was an average of 14, 25, and 25 days respectively.

Board 02 CATEGORIZING PREFERRED BARN OWL HABITAT IN OHIO. Jacob M. Gray, 13466 Charleston Pike, Kingston OH 45644. (Zane Trace Local Schools)

Barn owls, *Tyto alba*, are an endangered species in Ohio. Although their numbers have been increasing, in recent years, there are only a few areas in Ohio where they nest. In 1998 barn owl nests were found in only 17 of Ohio's 88 counties. This research proposed to determine why certain areas in Ohio are preferred by barn owls by examining the habitat through the use of agricultural reports, soil maps, Geographic Information System information and other similar published information. When information on current agricultural use and existing habitat was reviewed, counties along Ohio's glacial boundary were observed to most likely have nesting barn owls. In Ohio, 12 of the 17 glacial boundary counties had nesting barn owls in 1998. By reviewing the amount of Conservation Reserve Program (CRP) acreage, hay acreage and pasture acreage it was found that glacial counties with more CRP, pasture and hay were more likely to have nesting barn owls than counties away from the boundary. Meadow voles are primary prey of barn owls in Ohio, and meadow voles depend upon grassland and wet meadow habitat. In 1998 no barn owl nests were found in northern one-fourth of Ohio, and 33 of 79% of all known nests were in the southern one-half of the state. An index was used to rate and characterize habitat. It was found that most of the counties in Ohio where barn owls currently nest rank high in CRP, pasture and hay acres. Also these counties have relatively high amounts of glacial related soils, wet meadows and shallow wetlands. A county on the glacial boundary was far more likely to have nesting barn owls than counties in the glaciated or unglaciated regions of Ohio.

Board 03 THE MAJOR AMPULLATE GOLDEN DRAGLINE SILK AND THE HYPOTHESIZED MAJOR AMPULLATE SILVER DRAGLINE SILK OF *NEPHILA CLAVIPES*. Lisa M. Siciliano, 16001 Rowena Ave, Maple Heights OH 44137. LSicil8439@aol.com (Beaumont High School)

This experiment examined silk from *Nephila clavipes*, comparing major ampullate golden dragline silk and major ampullate hypothesized silver dragline silk for superior properties of strength, resistance to acid, and elongation. It was hypothesized that the golden dragline silk would prove to have superior properties for all the categories. Silk was obtained from *Nephila clavipes* spiders and evaluated using x-ray diffraction, SEM (scanning electron microscope), acid reaction timed with an Olympus BX60 optical microscope, and for supercontraction and elongation. Using x-ray diffraction it was discovered that the golden dragline has more crystalline regions (alanine beta-pleated sheets). Silver silk is almost as strong with only about 10-15% less crystalline regions than the golden silk. Since the golden dragline has more crystalline regions, it would be expected to have superior mechanical properties in regards to the strength of the silk. Examining the results of the

SEM project, I have again proven that golden dragline silk is stronger. The silver silk, under 8000x magnification had rougher edges and was not as smooth as the gold silk. The electrons from the microscope tended to shrink the diameter of the silks. The silver silk, when exposed to the electrons, became damaged very quickly in1-2 minutes. The gold silk was less affected by the electron beam. It shrank in diameter because of electrons, but it took about 4-5 minutes for any significant damage to occur at 8000x magnification. The silver silk was 3.5 m and the gold silk was 5 m under the same magnification. The gold silk was commonly found paired with another strand of gold silk. The silver was only found as single strands. The silver silk is expected to have superior elongation properties because it has fewer crystalline areas. To test this hypothesis, the silks were exposed to HCl and H_2SO_4. Using an optical microscope, I could not see the molecular changes, but I could observe that the silks were both dissolved by the acids, forming liquid drops after their dissolutions. I really saw no difference between the two silks when exposed to the acids. Lastly, the supercontraction and swelling phenomenon was observed for both silks when immersed in distilled water. Dragline silk, is the only silk which has been reported to supercontract to 50% its original length and swell when immersed in distilled water. The silver silk contracted about 5% more than the gold silk as shown by the x-rays. This is due to the fact that water is attracted to the amorphous regions first. It was concluded that the golden silk has the property of superior strength, the silver silk has the property of superior elongation, and both silks have the same resistance to acids.

Board 04 COMPARISON OF DIFFERENT METHODS OF ISOLATION OF GENOMIC DNA FROM MOUSE TAILS. Eric S. Steichen, 2735 Baker Place, Cincinnati OH 45206. steichene@aol.com (Seven Hills School)
When choosing a method to isolate genomic DNA from tissue, cost, efficiency, time, ease, and the purity and yield of the DNA isolated must be considered. The purpose of this study is to compare the total yield and purity of DNA isolated using the Potassium Acetate (after tail lysed, KoAc precipitates DNA pellet; washed, then resuspended), spooling (after tail lysed, precipitating DNA bound to sealed capillary tube; washed, then resuspended), and QIAmp Kit (after tail lysed, DNA bound to filter in spin column, washed, then eluted) methods for extracting DNA from mouse tails. It was hypothesized that the KoAc method would produce the highest yield, and the QIAmp Kit method would produce the highest purity, while the spooling method is outstanding in neither facet. Twelve prepared mouse tails from six week-old mice were sliced into 100mg segments for genomic DNA isolation. Each method was used on four tail segments. The optical density of a dilution of each of the twelve samples was read in duplicate. The DNA purity was calculated; the average final concentrations were determined for total yield calculation. Electrophoresis was done using a 1% agarose gel and 1µg DNA samples. Statview was used for statistical analysis. There is no statistically significant difference in DNA purity among KoAc, Spooling, or QIAmp Kit methods ($P>.05$). The KoAc and spooling methods produce significantly higher yields than the QIAmp Kit method (KoAc vs. QIAmp Kit: $P=.0173$; Spooling vs. QIAmp Kit: $P=.0030$). There is no statistically significant difference in total DNA yield between the KoAc and Spooling methods. All three methods produce DNA with comparable minimal degradation. When purity must be maximized in DNA isolation, any of the methods are appropriate. When yield must be maximized, either the KoAc or spooling methods are preferable.

Board 05 DAIRY COW'S RUMINATION IN RESPONSE TO LEVELS OF FIBER INTAKE AND TYPES OF CORN HYBRID. Dorothy E. Wu, 3945 Lytham Court, Upper Arlington OH 43220-4848. ladie85@aol.com (Upper Arlington High School)
Good rumen function is necessary for dairy cows in order to obtain maximum milk production. Enough eating/ruminating activity, which is stimulated by the diet, is necessary for proper rumination. The diets of dairy cows are made up of concentrates, forages, and by-products. Concentrates, which are high energy and low fiber feeds, provide the energy needed by the cows to maintain excellent milk production. Forages, which are high in fiber and low in energy, stimulate rumination and are needed to make up for the lowered pH of the rumen caused by high levels of concentrate. Ideally, diets should contain the minimum amount of forages necessary to maintain rumen function, while maximizing the energy intake to maintain the best milk production. The hypothesis is that more intake of forage neutral detergent fiber (FNDF) and/or a type of corn hybrid differing in digestibility (brown midrib corn silage versus control corn silage) will result in more eating and ruminating activity. Eight lactating Holstein cows housed were randomly assigned to one of the four groups with two in each group. Each of four experimental diets was fed to one of the groups. The subjects' activities are observed through a 48-hour period. Each subject's activities were recorded for every 5-minute interval. Statistical results show that there is no significant difference in ruminating for all groups; however, cows fed BMR (brown midrib corn silage) with lower FNDF (17%) spent significantly less time in eating than the other three groups.

Board 06 TISSUE CULTURE OF ASTROPLANT EMBRYOS AND TISSUE. Suzie M. Detrick, P.O. Box 116, West Mansfield OH, 43358. boss@bright.net (Benjamin Logan High School)
Are the suspensors of the embryos (cells that connect the embryo to the ovule) of astroplants influential in the development of the embryo. This question is being addressed by examining astroplant embryos (a variety of *Brassica rapa* with a short life cycle of 28-60 days) and ovules in tissue culture. A Scientific Laminar Flow Workstation model #1839 was disinfected with Invitro laboratory disinfectant. An astroplant pod was then placed in sterile cheesecloth and soaked in 10% Clorox with a drop a Tween 20 for five minutes, 30 seconds in 70% alcohol, and rinsed in distilled water. It was then transferred to a sterile petri dish and set in the workstation. Half of the full ovules had their ovule coat carefully dissected away (leaving the embryo) and was placed in astroplant media, liquid or solid, and under a fast plant light bank to grow and be observed. The ovule coat and the remaining half of the full ovules were placed in astroplant media and under the fast plant light bank to grow as well. To date, about 67% of the full size or walking stick embryos have grown and about 71% have been transferred from liquid to solid, in order to for the embryo to have more room for growth. Approximately 22% of the transferred embryos produced flowers. Three embryos were successfully isolated from the heart stage, but there was an absence of growth, as in there was an absence of growth in the ovule coats. About 60% of the full ovules grew, and all of them were transferred from liquid to solid. Thirty percent of the ovules grew to the stage of producing flowers, although the number range of flowers, in the embryos and ovules, was less than that in a non-sterile environment. The number of flowers produced in a sterile environment had a range of 3-6 flowers or an average of five flowers. The number of flowers produced in a non-sterile environment had a range of 6-11 flowers or an average of seven flowers. This work will be continued until the procedures are adequate for culturing the embryos from the globular stage.

Board 07 ROAD GRIME: A PLATINUM MINE? PHASE 2. Erin E. Sauer, 5185 Red Bird Ln, Hamilton OH 45011. dead_possum107@yahoo.com (Ursuline Academy High School)
Platinum is a slightly magnetic noble metal used extensively in industry. It plates the inside of automobile catalytic converters, and is thought to chip off over time, and be taken out with the exhaust and expelled onto roads. The purpose of this project was to find an inexpensive method to test for platinum, and to determine if platinum was present on heavily traveled roads. A method to measure pressure change as platinum catalyzes the decomposition of hydrogen peroxide was developed. Road dirt from an area of 19.8 square meters was poured down an aluminum chute with magnets to collect magnetic material. This material was then placed into 20% hydrochloric acid to dissolve organic matter clinging to the magnetic material, and each of the samples (5 total) was then tested in duplicate with hydrogen peroxide using a CBL and pressure sensor. Later, strongly magnetic material was removed from the samples, they were heat treated to 618 degrees Celsius, and retested in duplicate using a refined procedure. Samples were then tested using ICP to determine presence of platinum and legitimacy of the initial testing. It was hypothesized that a road being used by more cars would result in more platinum being found on that road. The results from ICP testing show that samples taken from heavily traveled roads contain platinum in amounts ranging from 0.9458 ppm to 0.8664 ppm, which slightly correlates to the results given from pressure sensing tests.

Board 09 ISOLATION AND CHARACTERIZATION OF NITROGEN-FIXING BACTERIA. Tian Zhang, 1547 Conneaut Ave, Bowling Green OH 43402. tianzhang@hotmail.com (Bowling Green High School)
Nitrogen fixation is of fundamental importance in the biosphere. In nature, this occurs via the biological nitrogen fixation reaction. A small but diverse group of diazotrophic microorganisms is able to fix atmospheric nitrogen. The main goal of this study is to characterize diazotrophic microorganisms from aquatic samples isolated from ponds around Bowling Green State University, Wood County, Ohio. Water samples of about 5mL were collected from 4 different locations and incubated for 7 days in nutrient media lacking a nitrogen source. Nine single colonies, effective in N_2-fixation, were isolated on Burk's nitrogen-free agar plates. As an initial identification process, the morphology of these isolated microorganisms was then investigated using scanning electron microscopy. Because all N_2-fixing microorganisms have the enzyme system of nitrogenase encoded by the *nifH* gene, this DNA sequence has been examined. To do this, PCR amplification of corresponding DNA using highly conserved oligonucleotide primers corresponding to the 5' (Primer 1: GATATCATGCGTCAATGCGCCATCTACGGC) and 3' (Primer 2: GGATCCTCAGACTTCTTCGGCGGTTTTGCCGACGATGG) ends of the *nifH* gene of *Azotobactor vinelandii* has been utilized. The products of this PCR amplification showed approximately 900 base pairs in size, which corresponds to the expected size of the *nifH* gene. These resulting segments are currently being subjected to partial sequence analysis (with the above-mentioned primers), to be used to identify the isolated diazotrophic microorganisms.

Board 10 THE EFFECTS OF CATERPILLAR DAMAGE, ULTRAVIOLET LIGHT, AND MECHANICAL WOUNDING ON PHYTOHORMONE-TREATED TOMATO PLANTS. Aaron L. Iverson, 2740 Buttermilk Hill Rd, Radnor OH 43066. iverson@bright.net (Buckeye Valley High School)
The effects of salicylic acid (SA) and jasmonic acid (JA) on the defensive (octadecanoid) pathway of tomato (*Lycopersicon esculentum* cv. Moskovich) grown with various stresses were studied. Seven physical treatments on the growth of tomato were tested along with the chemical treatments of SA, JA, and the control. The physical treatments included a control, mechanical wounding with hemostat, caterpillar (*Manduca sexta*) damage, and four variations of ultraviolet light-C range treatment. Plant rating, height, and dry weight were used to quantify the results. For the caterpillar treatment, the caterpillar's mass and the number of times the caterpillars fell off the plant were recorded. Results with the UV and wound treatments were inconclusive with respect to the effects of SA and JA on the defensive pathway of the plant; additional research is needed to clarify these effects. In contrast, SA and JA induced a large variation of caterpillar damage on the plants. Exogenous JA apparently increased the defensive mechanisms of the plant as caterpillar damage was much less. JA, the end product of the defensive pathway, is the signal of a plant which stimulates a defensive response to a stress. In contrast, plants treated with SA had little resistance to the caterpillars. SA blocks the production of allene oxide synthase

(AOS) in the octadecanoid pathway. AOS is a necessary enzyme to complete the pathway and when SA blocks its production, JA cannot be produced, resulting in reduced defense.

Board 11 KNOWLEDGE OF AGRICULTURE AND COMMUNICATIONS OF PETTISVILLE AND ARCHBOLD HIGH SCHOOL SENIORS AND AGRICULTURE EDUCATION STUDENTS. John J. Torres, 272 Main St, PO Box 54, Pettisville OH 43553. torres4@gateway.net (Pettisville High School)
The actions of communicating the research and the benefits of the agricultural industry is important to the world due to the large influence the industry has on our global economy and daily lifestyles. Therefore, it is extremely important that society raises and teaches its youth to fully understand the structure of this great industry. Students at Pettisville and Archbold High Schools in Fulton County Ohio were surveyed concerning their knowledge on agricultural communications. It was hypothesized that 50% or more of students enrolled in agricultural education would know the fundamentals in the areas of communications and agriculture, and less than 50 % of seniors not enrolled in Agriculture Education would understand the fundamentals of communications and agriculture. A Set of surveys was administered to a combined total of 97 students in agriculture classes and 95 seniors at both schools. There were two different surveys administered to seniors and Ag Ed students. Those involved in both educational studies were recorded once. Students responded to questions asked and listed and ranked items on a written survey. Answers were compared to an accepted set of responses that clearly revealed the student's knowledge of the material reviewed. The results are as follows: Ag Ed: Pettisville 69.5% knowledge retained, Archbold 59.5%, Seniors: Pettisville 74%, Archbold 69%, Comparisons made using both surveys from all Ag Ed students and seniors combined: Pettisville 71.5%, Archbold 63%. The results indicated that the majority of those tested are knowledgeable for a life dealing with the constant contact that the global economy has with the Agricultural Industry.

Board 12 A COMPARISON OF LONG AND SHORT-TERM MEMORY IN SENIOR CITIZENS AND HIGH SCHOOL STUDENTS. Kathryn A. Lawton, 2745 Wickliffe Rd, Columbus OH 43221. Lawtonerk@aol.com (Upper Arlington High School)
The popular myth that the memory of a senior citizen will significantly and automatically deteriorate with age is questionable. There are many senior citizens, such as John Glenn, who are still achieving tasks most younger people may never accomplish. This memory myth was tested using thirty-five high school students and thirty senior citizens to determine which group had a better short-term and/or long-term memory. It was hypothesized that high school subjects would have a significantly higher short-term and long-term average memory score than senior citizens. Each subject was asked to memorize factual information presented to him or her. They were then tested and asked to answer a questionnaire about other factors that may have influenced their score. This procedure tested short-term memory. Re-administering the same test one week later tested long-term memory. T-test results showed that there were no statistically significant differences between the average short-term and long-term memory scores of high school students and senior citizens. The t-test scores of 0.91 and 0.52, respectively, showed the short-term memory and long-term memory results were not significantly different. Other factors that may have affected these results were examined. Results from a Pearson Correlation analysis showed in some cases that blood pressure, stress, and education might have affected the average long-term memory score for senior citizens.

Board 13 THE EFFECTS OF NOISE ON THE OXYGEN CONSUMPTION OF HAMSTERS. Kristin E. Heller, 1245 N. Washington St, Delphos OH 45833. lizzybeth_kh@hotmail.com (Delphos Jefferson High School)
It is proposed that noise pollution is a cause of stress, with the volume of sound and rate at which sounds are heard affecting the metabolism. A direct link between oxygen consumption and metabolism allows the measure of one to suggest the state of the other. The goal of this project is to establish that sounds stimulate the body. Six hamsters (*Mesocricetus auratus*) were used, three were control, three were experimental. One hamster was placed in a sealed container and the amount of oxygen consumed estimated, based on the amount of carbon dioxide absorbed by soda lime that was also in the container. Effects of the rate at which sound pulsed and its decibel level, were examined in nineteen trials conducted on each of the six hamsters over a period of twenty-seven days. It is hypothesized that rapid and/or loud sounds increase the metabolic rate and soft measured sounds reduce the metabolic rate. Data collected in the trials showed that an increase in both the rates at which sound is pulsing and its decibel level resulted in an increase in the metabolism of the test subject. Conversely, a lower sound level pulsed at a slower rate, could lower the metabolic rate. Proper uses of sound may modify the metabolism to provide physical benefits due to reduced stress.

Board 14 THE EFFECTS OF WATER TEMPERATURE ON *TAGETES ERECTA* (AFRICAN MARIGOLDS). Elias J. Saliba, 6131 Corsica Dr, Huber Heights OH 45424. USAmericaN@hotmail.com (Carroll High School)
In a previous experiment it was shown that colder water significantly improves the growth of *Antirrhinum majus* (Snapdragons). Snapdragons evolved in the Appalachian and Rocky Mountain foothills. African Marigolds evolved in the Mexican tropics. This experiment tested if water temperature would have the same effect on tropical and mountainous plants. The original hypothesis stated that the water temperature of a plant's native climate would best improve the growth of that plant. There were four groups of forty-nine plants each. Group A received 5°C water, Group B 20°C, Group C 30°C, and Group D 50°C. The test ran four months. Group C was the tallest group, followed by D. Groups B and C had the most plants live, A was slightly behind them, and D was last, ten plants behind B. Group B had the most flowers, but only had a few more flowers than the other groups. The widths of the flowers were equal. Groups A and D had the thickest flowers. These results show that water temperature does not have as big an effect on Marigolds as it does on Snapdragons. This is because Snapdragons are more sensitive to their environment. Another factor is that Snapdragons may absorb water faster than Marigolds. This causes the water temperatures to be closer to room temperature when Marigolds absorb the water. A third cause is the environmental factor that triggers the growth hormones, known as auxins. Water temperature is the factor that triggers Snapdragons' auxins to go into the growth period. For African Marigolds, the deciding factor is not water temperature, so water temperature will only have minor effects.

Board 15 COOL COMPOSTING™: THE NATURAL FERTILIZER. Aaron M. Didich, 1312 Turner Rd, Bellefontaine OH 43311. tlk@logan.net (Bellefontaine High School)
In our ever-changing world there has always been the need for a quick, easy and environmentally safe medium for plant growth. Using non-meat household table scraps such as fruits, vegetables, eggshells, and coffee grounds provides a quick and inexpensive way to make and use compost. The ultimate goal of this project is to encourage the recycling of non-meat household table scraps in order to produce healthier and more prosperous plants not only with household gardens but also with urban farmers across the US as well. This method of composting is what I call Cool Composting. A standard mixture of non-meat household table scraps was blended in a Vita Mix blender with 1200cc. water which produced 1920cc. composting mixture. All of the plants were grown under the same conditions and treated separately with two different fertilizers, Miracle Gro and Cool Composting along with a control group for each. The initial data shows that the fertilizer treatment has been observed to possibly open a dormant metabolic pathway. This was observed by using Chromatography that was conducted at the University of Illinois, Chicago. The plants treated with Cool Composting produced more beans per plant, possessed a more developed root system, and upon testing plant samples, the Cool Composting plants showed a greater diversity of metabolites than those treated with Miracle Gro or the Control. Further studies will need to be conducted to identify these specific metabolic pathways and compounds that make the Cool Composting plant a major competitor with other types of composting and household fertilizers. Also, it is estimated that the cool composting process would eliminate 5,460 tons/year of household scraps or 27% of the food waste from the landfill. This projection is based on per household statistics and Cherokee Landfill statistics of Logan County.

Board 16 AN ALTERNATIVE USE FOR TOBACCO...IN SEARCH OF CORROSION INHIBITORS. Stephanie M. Gleason, 5708 S. Pitchin Rd, Springfield OH 45502. rgleason@erinet.com (Southeastern High School)
Previous research showed that a compound in tobacco inhibits corrosion of steel. Identification of such a compound could be commercially significant since many additives to paints and coatings are toxic to the environment. Earlier studies showed that when steel and water were combined, rust was visible on the steel and oxygen was consumed in the process. However, when steel and tobacco extract was combined, no rust was visible on the steel, but surprisingly more oxygen was consumed and the color of the solution turned dark brown. The purpose of this study is to identify a possible corrosion inhibitor in tobacco extract by using spectrophotometric methods. Shavings (each about 4.0 mm^2 surface area) were cut from a cold-roll steel rod (no cutting oil). Tobacco extract was prepared using unprocessed, dried tobacco leaves. Tobacco was weighed, combined with a volume of distilled water, and filtered before use. The four test solutions (300 mLs each) consisted of water, steel plus water, tobacco extract, and steel plus tobacco extract. Dissolved oxygen (DO) was measured using a DO meter and probe (electrode method). To identify a corrosion-inhibiting compound, absorbance spectra of test solutions were compared from 190 to 820 nm using a diode array spectrophotometer (minimum of two trials each). Results suggest that a compound reacts at the solution/steel interface. The compound has an absorbance maximum in the 250 to 265 nm range, suggesting a cyclic structure. This is consistent with previous work concluding that a pyridine-like compound, possibly nicotine, may be the inhibitor.

Board 17 COMPARING THE DISSOLVING RATES OF NAME BRAND AND GENERIC PAIN RELIEVERS. Jennifer N. O'Malley, 585 Gamewell Dr, Miamisburg OH 45342. omalleys@earthlink.net (Wantz Middle School)
This study was designed to help consumers gather some facts about pain relievers by seeing whether name brand or generic pain relievers dissolved faster, and which liquid, water, milk, acidified water (water mixed with hydrochloric acid to mimic the stomach environment), or Pepsi would help to dissolve the pills at the quickest rate. The hypotheses were that all name brand pills would dissolve at the same rate, and that all the pills would have a faster dissolution rate in Pepsi because Pepsi contains phosphoric and citric acids. Pills of each brand were placed into a 50 ml beaker filled with milk, water, acidified water, or Pepsi. They were stirred every twenty seconds for five minutes, and for ten minutes in another test. When this was completed, the contents of the beakers were poured and rinsed into coffee filters and weighed once dry. This was repeated until all the pills were tested, a total of 146 trials. The trials revealed that the name brand drugs, particularly Tylenol, dissolved the fastest, followed by Advil, Aleve, and their Wal-Mart then Rite Aid generic brands. All of the pain relievers dissolved the quickest in acidified water, followed by water, milk, and then Pepsi. In conclusion, for those who seek fast pain relief, Tylenol taken with water, which will be mixed with hydrochloric acid in the stomach, is the way to go.

Board 18 MULCH, MONOCOTS, OR DICOTS? WHICH HAVE THE BEST WATER ABSORPTION FOR BUFFER STRIPS IN URBANIZED AREAS? Gideon P. Steed, 5979 Radnor Rd, Radnor OH 43066. jrsteed@cc.owu.edu (Buckeye Valley Middle School)
Urbanization brings many large areas of compacted soil and contiguous acres of asphalt and often inadequate storm sewage systems. This has led to an increase of flash flooding, erosion, and overflow of sewage systems. Buffer strips of plants could be installed so root systems could prevent soil compaction, thus allowing water to travel to underground aquifers. Plants also deplete soil water by transpiration. Urban planners need to know which material will allow for the most water holding capacity or transpiration. Experiments were conducted measuring the amount of water absorbed by 3.5" containers of bluegrass, bentgrass, fescue, cornflower, buckwheat or mulch as compared to a control of bare soil. Water absorption was measured as the difference between the volume of water in a container before and after a pot was placed in it for 5 minutes. It is hypothesized that monocots fibrous root system would be able to absorb more water than the dicot tap root system. Seven trials were conducted 3 days apart. Chi square analysis and analysis of variance statistics were performed on the data sets. The dicotyledons (cornflower, cosmos, and buckwheat) were statistically significantly greater at absorbing water than the monocotyledons (bluegrass, bentgrass, and fescue). Both plant sets were statistically significantly greater than bare soil or mulch. This would suggest that the use of dicotyledons in buffer strips in areas displaying storm water runoff would aid in damage control.

Board 19 DISNEY'S DREAM COME TRUE: COMPARISON OF HYDROPONICS AND AEROPONICS. Crystal L. Cornett, 4790 Carters Corners Rd, Sunbury OH 43074. crystal_cornett@hotmail.com (Big Walnut High School)
The goal of this research is to investigate two alternative methods of agriculture: hydroponics, the growing of plants without soil in a nutrient solution; and aeroponics, the growing of plants in air, pulse-misting the roots with nutrient solution. The purpose of this experiment was to determine how the systems compare as alternative methods of agriculture. It was hypothesized that aeroponics would be a viable method of agriculture, both systems would have similar germination rates, and the aeroponic system would have faster growth rates. The approach was to construct a hydroponic wicking system and an aeroponic misting system, each supporting fourteen chili pepper plants. Total nutrient content, chlorophyll content, height, biomass, and nutrient solution usage were compared between the systems. The hydroponic plants grew on average 22.3% taller and had an 8.9% higher average chlorophyll content than the aeroponic plants. The aeroponic system used 50% less nutrient solution, had a 31.6% higher average per plant biomass, and an 11.2% higher totalbiomass. The aeroponic plants had a much slower start compared to the hydroponic plants. Due to the design of the aeroponic system, the roots had difficulty growing down into the misting plenum. Both systems promotedthe growth of healthy plants; however, the aeroponic plants were observed to exhibit an uneven distribution of chlorophyll based on leaf coloring.This is a characteristic symptom of manganese toxicity, further supported by testing that showed an increased level of manganese in the leaves. This experiment validated aeroponics as a viable alternative method of agriculture.

Board 20 DO CONNECTING RIVERS AND STREAMS HAVE THE SAME WATER CHARACTERISTICS? A COMPARISON OF THE WATER QUALITY OF THE OHIO RIVER, LITTLE MIAMI RIVER AND CLOUGH CREEK. Jill E. Neagle, 7195 Regiment Dr, Cincinnati OH 45244. paul.neagle@delta-air.com (Turpin High School)
Do connecting rivers and streams have the same water characteristics? The initial hypothesis states that water samples collected from the Ohio River, Little Miami River and Clough Creek would yield similar results. Test kits from Hach and other sources were used to test the water collected for pH, hardness, ammonia, nitrate nitrogen, iron, alkalinity, dissolved oxygen and bacteria. These tests were considered standard water quality measurements. Within the same hour one sample of water was collected from each of the three water sources. All tests were then conducted and the results were recorded in the same afternoon. The tests for pH, hardness, ammonia, nitrate nitrogen, iron, alkalinity, dissolved oxygen and bacteria were conducted and the data was recorded, graphed, and used as a basis for comparison. The results were graphed by specific characteristic tested at each water source. The graphs indicated significant measurable differences in the water quality of the three water sources, thus disproving the original hypothesis.

Board 21 IS MECHANICAL ENERGY CONSERVED ON A MODEL ROLLERCOASTER? Aaron K. Clark, 7285 Sugarwood Rd. N.E., Canton OH 44721. Clarkbar@neo.rr.com (Plain Local-Glen Oak Career Center)
The problem was, "how much does friction and air resistance affect the total energy of a rollercoaster?" It was said that the coaster car would lose at least 50% of it's total energy, due to friction and air resistance. The experiment used a photogate infrared sensor to detect the model coaster cars velocity as it passed by two locations on the coaster circuit. The data was then used to find the kinetic energy at the points, and compare them. 5 trials were run from each location. The model used was built from polyethylene tubing for the rails, and gutter clips; wood for the supports; plywood, model aircraft wheels, legos, Pinewood Derby weights; piano wire, screws, and a TI-82 paired with a calculator based laboratory, and a photogate infrared sensor. In the end, it was observed that the coaster had only kept 18% of it's total energy.

Board 22 UP OR DOWN: DO PLANTS KNOW THE DIFFERENCE? Travis P. McCarthy, 972 Glendale Dr, Batavia OH 45103. cornmo@chmcc.org (St. Vernoica School)
Gravity is the force that holds everything down. If gravity is altered, humans sense it and reorient themselves, but can plants do the same? To answer this question the growth of Crimson Giant radish seedlings (*Raphanus satious*) were used to evaluate the following hypothesis: seedlings will respond rapidly and continuously showing negative gravitropism in a 96 hour period, not respond with centrifugal force, and show both positive and negative gravitropism when the gravity is altered along with centrifugal force. 40 Radish seeds were grown under the recommended growing conditions as controls. In addition, 12 seeds (4 per pot) were grown with their growing pots oriented in different positions (1 upright, 1 sideways, and 1 on turntable @ 33 rpms). Another group of 8 seeds (4 per dish) was grown in petri dishes (dish 1 - control and dish 2 altered gravity). A final group of 48 seeds (4 per can) were grown in film can chambers (complete darkness) with their chambers oriented in different positions and altered gravity (4 upright, 4 on turntable turned on side @ 33 rpms, and 4 on a slow clinostat @ 1 rpm). At timed intervals (2 x per day), seedlings were observed and the length and direction of shoots and roots recorded. After 96 hours total length measurements of the roots and shoots were averaged and compared. The direction (angularity) of the roots and shoots were also compared. The results showed that there was varied growth differences and angularity of the root and shoots displaying both positive and negative gravitropism. It was concluded that plants do respond to gravity and centrifugal force in their orientation. In addition, this altered gravity affects the growth in length of the plant's roots and shoots.

Board 23 THE EFFECTS OF LIGHT ON PAINT. Brittanie N. Sicker, 5952 Linder Cir N.E., North Canton OH 44721. bns@neo.rr.com (Our Lady of Peace)
The effects of light on paint were studied. The hypothesis was that certain paints, when exposed to certain lights, would start to deteriorate. To test the hypothesis, five commercial, three acrylic, three water-color, two oil paints, and pink construction paper were exposed to constant, direct light. The light sources were different types of luminescent and incandescent lights. In the primary experiment, the samples were placed into a light box containing four chambers. Three chambers contained different types of fluorescent tubes used for visible lighting. The fourth chamber contained a black light fluorescent tube producing a much higher amount of ultraviolet rays than the others. A portion of each sample was set aside and protected from all sources of light as a control for comparison at the conclusion of the experiment. The samples were then exposed to one thousand hours of continuous direct light. The results varied depending on the type of paint tested. In the time available, there was no noticeable deterioration of any of the commercial, acrylic, or oil paints from any light source. The water-color tests proved the hypothesis to be correct. The water-colors not only deteriorated, but different colors reacted differently to the same light source, and different light sources caused different rates of deterioration of the same color. The conclusions were that the more ultraviolet rays produced by a light source, the faster paint will deteriorate, and the more pigment in the paint, the more it resisted fading.

Board 24 ANTIBIOTICS VERSUS HERBS WHICH WILL KILL BACTERIA BEST? Tiffany A Janis, 3284 Meanderwood Dr, Canfield OH 44406. Tiffa1b2c3@aol.com (Immaculate Heart of Mary)
The purpose of this experiment was to test popular herbs against antibiotics that have been in use for many years. Recently, antibiotics are starting to be resistant to bacteria. I wanted to see if the use of herbs could have the same antibacterial effect. Specifically, I chose Echinacea and garlic. Garlic was used in ancient times and reportedly helped the cardiovascular system. Echinacea is a wildflower that reportedly controls the symptoms of the cold and the flu.The antibiotics, Tetracycline and Penicillin, were chosen because they both can cure many diseases. Penicillin is made from molds and can cure strep throat. Tetracycline can cure Lyme Disease, acne, and Chlamydia. The hypothesis was that antibiotics will work better than the herbal medicines. The materials used were Tetracycline, Penicillin, garlic, Echinacea, an incubator, nutrient agar, agar dishes, forceps, sterile swabs, and control disks. A sterile swab was rolled over my tongue and rubbed on the prefilled agar dishes. Antibiotics and herbs were applied to disks that were placed on each agar plate. I also had one disk with bacteria, but without antibiotics or herbs. Labeled dishes were incubated for forty-eight hours at 80 degrees F. The results supported my hypothesis. Penicillin controlled the growth of bacteria best,garlic was more effective than Tetracycline, and Echinacea was the least effective at controlling the growth of bacteria.

Board 25 HOW DOES WHITE LIGHT CHANGE INTO COLORED LIGHT? Jamie L. Rhodes, 58686 Eileen St, Rayland OH 43943. rhodes4@1st.net (St. Mary Central School)
The purpose of this experiment was to discover how white light changes into colored light. The goal was to develop an experiment that would successfully separate white light into different colors of light. Using a flashlight, a white cotton sheet, and a prism, I was able to separate the light of the flashlight into all seven colors of the visible spectrum by shining the flashlight through the prism and onto the sheet. I found the brightest color to be yellow. When shining a flashlight through one red and one violet piece of cellophane and onto the sheet, the only color to appear matched the cellophane's color. This color was very dim. The hypothesis was that white light changes into colored light when it reflects off of various colored objects. The hypothesis was not supported. When testing the white light, I found that instead of the light changing when it bounces off of colored objects, the colored light appears when all colors are absorbed, except for the visible color which is reflected. White light changes into colored light when the light refracts. Red light refracts the least, violet the most. Yellow appears as the brightest color. I concluded that white light is composed of all the colors of the spectrum. These colors appear when white light is shone through a prism. If a specific color appears, it is because that color is reflected and all other colors are absorbed.

Board 26 BOILING POINTS OF WATER. Justin R. Rigling, 2895 Tolbert Rd, Hamilton OH 45011. JJRigling@worldnet.att.net (St. Julie Billiart School)
It is hypothesized that the boiling point of water is inversely related to elevation. This was tested by boiling 8 ounces of water in a glass jar at different vacuums. Vacuums were created that related to elevations varying from 0 feet to 37,000 feet of elevation. To simulate higher altitudes, pressures less than that found at sea-level were created using an electric vacuum pump, a vacuum tank, and a vacuum gauge. A digital thermometer was used to record the temperature of the water. This showed the temperature at which the water boiled. A vacuum gauge monitored the vacuum in the jar. Three trials were run for each of several vacuum values. Vacuums of 0, 5, 10, 14.5, 18, 20 and 23.5 (in of Hg) were created. The data for each trial was recorded in a spreadsheet. The boiling point for each different pressure was averaged. This data showed that changes in atmospheric pressure affect the boiling point of water. While conducting these experiments I found that there are other things that affect the heat required to keep the water at boiling point. For example the temperature suddenly dropped when the water started evaporating, due to the absorption of heat as the water expanded into a gas.

Board 27 HOW AGE AND GENDER MAY AFFECT SHORT TERM MEMORY. Anna L. Kellgreen, 5101 West Blvd, Youngstown OH 44512. yogie03@aol.com (Boardman High School)
Teenagers and young adults are supposed to remember more than older people; women are expected to remember more than men. A ten-word poster was used for testing. Four math problems were used (addition, subtraction, multiplication, and division) for the purpose of distraction from the word list. A method was developed of recording the data using pink and blue sheets for easy gender recognition. One hundred twelve people were tested, four of each gender in each five-year age group. Each person was tested privately. Each had one minute to study the word poster, one minute to work on the math problems, then one minute to recall as many words as possible from the word poster. Responses were recorded on data sheets and then compiled the responses using line graphs and bar graphs. Based on the results younger people do remember more. Data showed that young people, 11 through 30 years old, recalled 82.2% of the words, while older people, 61 through 80 years old remembered only 55.9% of the words. This may be a result of how young people study for tests. Overall, women recalled 79.3% of the words while men recalled 63.8%.

WATER MANAGEMENT FOR ENVIRONMENTAL QUALITY

09:00AM SATURDAY, APRIL 1, 2000

MEYER HALL ROOM 121

BARRY J. ALLRED - PRESIDING

9:00 TREATMENT OF TOXIC ORGANIC WASTEWATER WITH CHEMICAL OXIDATION, CARBON ADSORPTION AND BIOAUGMENTATION. Howard H. Lo, Cleveland State University, Dept of Biological, Geological and Environmental Sciences, Folake O. Fasanmi and Yung-Tse Hung, Civil and Environmental Engineering Dept Cleveland OH 44115-2440. hlo@mail.bges.csuohio.edu
The objective of this study was to investigate the optimum conditions in treating toxic organic wastewater using chemical oxidation, activated carbon adsorption and bioaugmentation. Resorcinol, vanillin and salicylic acid, were the three types of wastewater used in this study. Chemical oxidation was carried out using two oxidants: Fenton's reagent and potassium permanganate. Carbon adsorption involved using six types of activated carbon. Bioaugmentation involved using two types of liquid live microorganism (LLMO). The removal efficiency of total organic carbon (TOC) was used as an indicator of performance for wastewater treatment. The results showed that the highest TOC removal efficiencies of 73%, 74% and 80%were achieved with resorcinol, vanillin and salicylic acid respectively, by using Fenton's reagent. With the potassium permanganate, the highest TOC removal efficiencies for resorcinol, vanillin and salicylic acid were 90%, 75% and 80% respectively; however, large sludge volumes were accumulated. It is found that bioaugmentation was ineffective in treating the three organic compounds and sludge production during the use of potassium permanganate made the use of this oxidant unacceptable during chemical oxidation.

9:15 A SURVEY OF SYCAMORE CREEK FOR OIL AND GREASE CONCENTRATIONS FOLLOWING THE KIRBY TIRE FIRE. Erica N. Roche (Dr. Josie Setzler), 3619 St. Rt. 61, Sunbury OH 43074. eroche@mail.heidelberg.edu
Not long after the fire started at Kirby Tire Recycle in late August of 1999, the Ohio EPA implemented remediation of the waters in Sycamore Creek to remove harmful chemicals and oils. This survey was conducted to determine if the remediation of Sycamore Creek by the EPA was successfully removing oil and grease from the water caused by the recent tire fire. If the aeration and skimming efforts of the creek are removing oil and grease from the water, then their concentration should decrease downstream from where the fire took place. Five sites along the creek were sampled, using procedures in *Standard Methods for the Examination of Water and Wastewater*. The results showed the following: 1) the site upstream of the fire contained 139.17 mg/L of oil and grease, 2) the site right next to the tire fire showed an average of 1006.45 mg/L, 3) two downstream sites had concentrations of 1262.11 mg/L and 222.82 mg/L and 4) the site at mouth of the creek was a negative value. These results show that while there is contamination coming from an upstream source, the bulk of the oil and grease is coming from the tire fire. The decreasing concentrations show that the remediation is working and/or the stream is diluting the concentration on its own.

9:30 THE WETLAND-RESERVOIR-SUBIRRIGATION-SYSTEMS (WRSIS) PROJECT. Norman R. Fausey, Richard L. Cooper, Barry J. Allred, Larry C. Brown, Bernie J. Czartoski, USDA, ARS, Soil Drainage Research Unit, 590 Woody Hayes Dr, Columbus OH 43210-1057. fausey.1@osu.edu
In an effort to reduce the delivery of nonpoint source pollutants from agricultural lands to surface waters, the WRSIS concept was developed. This innovative concept includes the capture, treatment, and reuse of surface and subsurface drainage waters and involves using constructed wetlands, storage reservoirs, and subirrigation. Funding was obtained from USEPA, Great Lakes National Program Office to construct three systems, one each in Fulton, Defiance and Van Wert counties. These systems were constructed in 1995-1996 and have been in operation during four cropping seasons. The sites range from 27 to 60 acres in size. Additional funding was obtained to monitor the hydrologic and water quality performance of the systems, and these sensors and samplers have recently been installed. As designed, the systems capture and retain virtually 100 percent of the drainage and runoff water thereby essentially eliminating offsite delivery of water and sediment. The constructed wetlands were allowed to revegetate naturally, and macro-invertebrate and vegetation surveys show that wildlife habitat and wetland vegetation features have developed. Corn and soybean yields are 15 to 40 percent higher for the subirrigated areas compared to adjacent areas with similar agronomic management but no subirrigation. Data collection will continue for 3 to 5 more years, but initial results demonstrate that WRSIS systems have potential to control non-point source pollution from cropland.

9:45 NITROGEN CYCLING IN A WRSIS AGROECOSYSTEM. N'Deye-Marie N'Jie, Larry C. Brown, and Norman R. Fausey, Ohio State University, Environmental Science Graduate Program, Dept. of Food, Agricultural and Biological Engineering, 590 Woody Hayes Dr, Columbus OH 43210. njie.1@osu.edu
A Wetland-Reservoir-Subirrigation System (WRSIS) is an agroecosystem that has the potential to improve downstream surface water quality by minimizing nutrient loads to surface water bodies. WRSIS can also provide a reliable source of subirrigation water to cropland. Minimal nutrient discharge to streams can be achieved by recycling drainage waters and surface runoff from a cropland (2.8 ha), through a constructed wetland (0.2 ha) and a reservoir (0.2 ha) for subirrigation during the growing season. System performance is evaluated by studying the transport and storage of nitrogen (N) in and out of each WRSIS component. An extensive monitoring system, implemented at the Defiance County, Ohio site in June 1999 has the capability of sampling runoff and subsurface drainage at eleven key locations. Initial findings revealed that for February through May, 1999 (grab samples), the average nitrate N (NO_3-N) and ammonium N (NH_4-N) concentration in runoff entering the wetland was 0.83 and 0.15 mg/L, respectively. Over the same period, the average concentration of NO_3-N and NH_4-N in the subsurface drainage entering the wetland was 11.39 and 0.00 mg/L, respectively. For June through August, 1999 (automated sampling), the average NO_3-N and NH_4-N concentration in runoff entering the wetland was each 0.03 mg/L. The average NO_3-N and NH_4-N concentration in subsurface drainage entering the wetland was 0.94 and 0.01 mg/L. Additional data will help evaluate the reduction in N loads that were previously lost to nearby streams. Further studies will also identify wetland processes and water management practices that influence N fate and transport in these novel agroecosystems.

10:00 PHOSPHORUS FATE IN A WETLAND-RESERVOIR-SUBIRRIGATION SYSTEM. Jennifer L. Kemerer, Ohio State University, Environmental Science Graduate Program, Dept. of Food, Agricultural and Biological Engineering, 590 Woody Hayes Dr, Columbus OH 43210. kemerer.2@osu.edu
Phosphorus loading in runoff from agricultural areas is a significant source of nonpoint pollution to natural waterways. A Wetland-Reservoir-Subirrigation System (WRSIS) is an innovative environmental management tool used to reduce nonpoint source pollution. The WRSIS in Defiance County routes subsurface drainage and runoff waters through a wetland for water quality improvement and then stores it in a reservoir for future irrigation of cropland. This research investigates the fate of phosphorus in various components of the WRSIS, to test the following hypotheses: 1) the wetland and reservoir act as sinks for sediment and phosphorus, 2) a concentration gradient for total filterable solids and phosphorus extends from the top to the bottom of the water column, and 3) subsurface drainage promotes movement of phosphorus down through the soil profile. Sampling methods include: 1) automated samplers for water flow, 2) a multi-elevation sampling system for water column samples, and 3) soil samples from both subirrigated and drained-only plots, and in the wetland. Total and available phosphorus contents were determined colorimetrically. Total filterable solids were determined by filtering a known volume of water. The reservoir and wetland both exhibited sediment and phosphorus retention. A significant increase in the total filterable solids was found between the surface and bottom waters of the reservoir ($p=0.03$), but not in the wetland. Total phosphorus levels were lower at greater depths in drained-only plots and higher in subirrigated plots, suggesting that transport of phosphorus through the soil profile was not promoted by subsurface drainage.

10:15 VEGETATION INVENTORIES FOR CONSTRUCTED WETLANDS OF THE WETLAND-RESERVOIR-SUBIRRIGATION SYSTEMS. **Lee M. Luckeydoo, Ohio State University, Environmental Science Graduate Program, Dept. of Food, Agricultural and Biological Engineering, 590 Woody Hayes Dr, Columbus OH 43210-1057. luckeydoo.1@osu.edu**

The Wetland-Reservoir-Subirrigation-Systems (WRSIS) project links agricultural fields, constructed wetlands, and water storage reservoirs to minimize agrochemical runoff and sediment delivery to streams. Currently there are three demonstration sites which are located in Defiance, Fulton, and Van Wert counties in northwest Ohio. Wetland construction was completed four years ago. Case studies of terrestrial and aquatic vegetation development and structure with passive revegetation on the constructed wetland sites were conducted using a seasonally permanent plot technique, and observations were made using Braun-Blanquet scales. Diversity by site was calculated using Simpson's and Shannon-Wiener indices. Defiance County had the highest species richness in 1998 at 51 species, with 33% being wetland indicator species. In 1999, species richness in Defiance County decreased to 31 species with 35% considered wetland indicator species. Fulton County species richness increased from 32 species in 1998 to 34 in 1999. Species richness at the Van Wert County site decreased from 44 species in 1998 to 24 species in 1999. Seed bank analysis of the Defiance location soils showed a potential of seven additional wetland species not present during the 1998 field surveys. The examination of the seed bank identified needed wetland modifications for the Defiance County site, where a mudflat component was added in early 1999. Results thus far indicate that, over time and with careful management of hydrology, there is potential for inclusion of additional wetland species.

10:30 WETLAND-RESERVOIR-SUBIRRIGATION SYSTEMS (WRSIS): ECONOMICS and HYDROLOGY. **Larry C. Brown, Marvin T. Batte, Jon A. Hothem, Steve Richards, Norman R. Fausey, N-Deye M. N'Jie, Lee M. Luckeydoo, Jennifer L. Kemerer, Tekin Oztekin, Barry J. Allred, and Bernie J. Czartoski, Ohio State University, Dept. of Food, Agricultural, and Biological Engineering, 590 Woody Hayes Dr, Columbus OH 43210-1057. brown.59@osu.edu**

WRSIS have potential to improve downstream water quality by reducing discharge to streams, providing wildlife habitat, increasing wetland acres and vegetation, providing a reliable supply of subirrigation water for sustained crop production, and increasing profitability. Economic analyses, completed for three sites in Northwest Ohio, indicate that capital costs, while variable from site to site, are by far the largest expense. Although the value of yield improvements was substantial ($35,598), and the discounted 30-year value of tax offsets was large ($20,340), the WRSIS investment at the Fulton County site resulted in a negative Net Present Value of $11,241. Given the investment requirements at these three demonstration sites coupled with analysis assumptions, the WRSIS was not profitable. However, costs and returns of this developing technology were shown to vary substantially from site to site, and economies may also be associated with scale of farming operations. Hydrologic simulation analyses of routing water through the system at the Defiance County site indicated that the current size of the constructed wetland provides a 76% and 42% water retention efficiency for 2-Year and 50-Year Return Period storms, respectively. By increasing the size of the wetland by 200% and adding another pump, the water retention efficiency was increased to 90% and 53% for these two return period storms, respectively.

Social & Behavioral Sciences
09:00AM Saturday, April 1, 2000
Meyer Hall Room 122
Joyce M. Kiser - Presiding

9:00 RELAXATION TAPES AND THEIR EFFECTS ON THE REDUCTION OF TEST ANXIETY AND TEST PERFORMANCE. **Jessica M. Broz, Jennifer Dembinski, Cindy Eldridge, 803 5th St. #3, Bowling Green OH 43402. jmbroz10478@yahoo.com.**

Previous research has found that academic examinations cause anxiety responses in students. It has also been found that relaxation tapes reduce heart rate and blood pressure. However, there have been few studies on whether the physiological effects of anxiety can be reduced by using relaxation tapes during testing conditions. With knowledge of these findings, this study was designed to test the effects of relaxation tapes on reducing test anxiety and improving test performance. It was hypothesized that playing a relation tape during a timed test would reduce physiological arousal and increase performance. Nine participants, four male and five female college students, were monitored for changes in heart rate and galvanic skin response during a timed math flashcard test. Overall, participants in the experimental condition exhibited lower heart rate increases during the flashcard test than the participants in the control condition did. Participants in the experimental condition experienced a 12.098% increase in heart rate. However, there was very little difference in performance between the two conditions. Students in the experimental condition received an average test score of 94.4%, while students in the control condition received an average test score of 95.5%. Therefore, the results of this study suggest that the use of relaxation tapes during testing situations reduces physiological anxiety responses, but does not affect test performance.

9:15 BODY IMAGE AND SELF-ESTEEM AMONG ADOLESCENT ORGAN TRANSPLANT SURVIVORS. **Meghan A. Warner (Dr. Laura Bennett-Murphy), Otterbein College, Box 11106, Westerville OH 43081. MGHAWRNR@otterbein.edu**

Adolescence marks a period in human development of extraordinary transition and self-exploration. However, what are the consequences of a near-fatal illness to this development? Adolescent cancer survivors report lower self worth, less involvement in social activities, and more social anxiety (Pendley, Dahlquist, and Dreyer, 1997). Additionally, worse health has been associated with perceiving oneself to be less attractive (Rosenthal and Smith, 1996). It is hypothesized that adolescent (ages 13-19) organ transplant survivors will have a more negative body image and thus a lower self-esteem than healthy adolescents will. It is further hypothesized that the body image a transplant survivor has will be more negative than the body image an objective observer will have about that same survivor. Two groups, ten transplant survivors and ten healthy control subjects, will be matched by gender and age. Participants will complete two questionnaires: The Body Image Instrument and The Self-Perception Profile for Adolescents. Two photographs will also be taken (one full body and one facial) of each subject. The pairs of photographs will be shown to five objective observers who will rate appearance for each subject on a five point Likert scale. Employing t-tests and ANOVAs, correlations from all measures will be calculated. It is believed that this study-in-progress contributes to the current literature by examining the psychosocial impact of a rare near-fatal illness among adolescent organ transplant survivors.

9:30 COST OF COMMUNITY SERVICE STUDY, SHELBY COUNTY, OHIO. **Tracy L. Reiss, Davey Resource Group, 1500 North Mantua St, Kent OH 44240. treiss@davey.com**

Development pressures in Shelby County, Ohio re mounting and urbanization is irreparably altering the rural countryside. As a result of this growth, and the subsequent increase in demand for public services, Shelby County needed to determine the economic impact of increased residential development. The primary purpose of the "Cost of Community Service" study was to generate data that could clearly demonstrate the fiscal impact of continued residential development in rural areas. In accordance with a methodology devised by the American Farmland Trust, and data supplied by the Shelby County Auditor's Office, county-level revenue and expenditure streams for fiscal year 1997 were analyzed and land use ratios generated. The findings of the study illustrated residential land uses were a financial drain on the Shelby County budget. Furthermore, the study articulated how much residential land uses cost to service relative to what they pay out in the form of revenue. Specifically, for every dollar raised from residential land use related revenues, Shelby County spent $1.11 in direct services. The study also demonstrated the manner in which farm, forest, and open space land uses were positive fiscal contributors to the county's bottom-line. Specifically, for every dollar raised to provide public services for farm, forest, and open space uses, only $0.29 was spent to provide services to these land uses. As a result of this study, Shelby County decided to promote the preservation of farmland as a sound community investment strategy as a component of the update of their Comprehensive Plan.

9:45 COUNTY ENVIRONMENTAL HEALTH IN OHIO: PERCEPTION AND REALITY. **Michele Morrone, Ph.D. and Timothy J. Ryan, Ph.D., CIH, Ohio University, School of Health Sciences, 416 The Tower, Athens OH 45701. morrone@ohiou.edu**

There is an increasing body of research examining the public's perceptions of environmental issues. These perceptions are referred to in the literature both as "risk perception" and "environmental awareness." Those who study risk perception and environmental awareness have focused mainly on increasing understanding of the public's perception and awareness. Past research has also examined the effect that public perception and awareness have on environmental decisionmaking and behavior. The investigation presented here contributes to environmental perception research by adding two new dimensions: 1) an analysis of perceptions of a specific group of professionals who are responsible for protecting environmental health in Ohio counties; and 2) a comparison of these qualitative perceptions with quantitative environmental data. Governmental health professionals in Ohio assessed the overall environmental conditions in their counties in a newly-developed electronic and mail survey. The professionals also made comparisons between environmental health conditions in their county with other counties in the state. A descriptive analysis of the results of the survey is presented. Ohio county health professionals perceptions of environmental conditions are compared with quantitative data that indicate actual environmental conditions in their counties. As correlation analysis shows, some issues, such as septic systems and incidence of tuberculosis offer interesting relationships between what the health professionals perceive to be problems and what actually exists. Ultimately, research such as this may allow for less-costly data gathering about environmental issues, as well as provide rapid, yet reasonably accurate information on such matters. The utility of such data sets may be proved for emerging concerns and the development of new environmental quality indices.

10:00 THE IMPACT ON SENSORY, MOTOR AND BEHAVIORAL DEVELOPMENT OF THE HOUSE MOUSE (*MUS MUSCULUS*) FROM PRENATAL EXPOSURE TO PARA-CHLOROAMPHETAMINE. **Julie M. Moyer and Nelson J. Moore, Ohio Northern University, 402 W College Ave, Unit 2552, Ada OH 45810-6039. j-moyer@onu.edu**

Research has shown that methamphetamines, stimulant drugs that are used on the street, may cause defects in the behavioral and sensory development in rat pups. Pregnant laboratory mice (*Mus musculus*) were injected with para-chloroamphetamine. Each of

three treatment groups (N=10 per group) were injected with isotonic saline solution, 2mg/kg, or 4mg/kg body weight of para-chloroamphetamine between days 7-18 of the gestational period. The number of mouse pups in each group was 44, 50, and 47 respectively. Mouse pups were tested for differences in birth weight, olfactory orientation (with and without bedding) on days 11 and 13 and for locomotor movements in a T-maze on days 15, 20, and 25. Multiple comparisons were done between the three groups and within each group. ANOVA showed significant differences (p=0.05 or less) between the three groups for the mean individual weights of the mouse pups (p=0.00); motor movement without bedding on postnatal days 11 and 13 (p=0.02-0.04); and for various locomotor movements in the T-maze on days 15, 20, and 25 (p=0.00-0.04). Significant differences were found between days 15, 20, and 25 when comparing the locomotor movements within each individual treatment group (p=0.00-0.01), with the least locomotor movement observed on day 15. In general, the results showed that pups from mothers injected with 4mg/kg body weight of para-chloroamphetamine showed the greatest differences in birth weight by being heaviest, in olfactory orientation by being most disoriented, and in locomotor activity by moving the least.

10:15 THE EXTRAORDINARY LIFE OF AN EARLY CLEVELAND SCIENTIST: HAMILTON LANPHERE SMITH. Joy M. Kiser, Cleveland Museum of Natural History, Cleveland OH 44106. jkiser@cmnh.org

Hamilton L. Smith was a Yale University graduate who taught chemistry in the Cleveland in 1845 and became a member of Jared Potter Kirtland's *Arkites*. He was curator of specimens that formed the foundation of the collections in the Cleveland Museum of Natural History and later became a college teacher and author of textbooks, devised a system for describing diatoms and desmids, and invented the tintype. The goal of the research was to determine whether Ohioan's, educators, and students of history and science should revere his work and consider him to be a significant early American scientist? Smith's articles, textbooks, tintypes, and personal correspondence were examined and news clippings, personal letters, articles, and monographs with references to Smith and his work, written by his family and associates. The data will show that H.L.Smith's work served as an essential bridge to later developments in photography, astronomy, and microscopy.

EDUCATION

02:00PM SATURDAY, APRIL 1, 2000

MEYER HALL ROOM 122

KENNETH A. LASOTA - PRESIDING

2:00 A SIMPLE CLASSROOM MANAGEMENT TECHNIQUE TO HELP GET STUDENTS SEATED AND LECTURES STARTED ON TIME. Kenneth A. LaSota, Robert Morris College, Dept of Natural Sciences, 600 Fifth Ave, Pittsburgh PA 15219-3099. lasota@robert-morris.edu.

Students that arrive late for class present a problem: Do you start class with students "missing in action" or do you wait for late arrivals, consuming lecture time in the process? How do you prevent late arrivals from disrupting class as they move to their seats? Reviewed here is a simple method I have used for ten years that addresses late arrivals and consists of two parts: First, in class students may sit where they wish but once they sit someplace they are required to sit there all semester. Second, a row of seats nearest the door is reserved where no students may sit except those that arrive late; that is, once class begins and students arrive late, they are welcome, but may not sit where they normally sit but only in the row of seats provided. This policy is not punishment for being late but is for the benefit of the class because it assures on time lectures and reduces disruptions by late arrivals. The method has markedly reduced tardiness, in part, because students prefer to sit where they normally sit and arriving late requires them to sit elsewhere. Significantly, because this method assures lectures start on time, lectures rarely extend over. Anecdotal evidence suggests students find this benefit a reasonable trade-off for being prompt.

2:15 USE OF A SUPERFUND SITE AS A HANDS-ON LEARNING LABORATORY FOR ENGINEERING DESIGN STUDENTS. Ann D. Christy, Julie Weatherington-Rice, and Andy D. Ward. Ohio State University, Dept. of Food, Agricultural, and Biological Engineering, Columbus OH 43210. Christy.14@osu.edu

Students from two courses in the Dept of Food, Ag, and Biological Engineering participated in a site investigation at an abandoned Superfund site, the Uniontown Industrial Excess Landfill in Stark County, Ohio. The two courses were both senior-level design courses, one on soil & water engineering and one on biological engineering. The purpose was to assist the township and to provide a real-world design experience for the students. Students visited the site, developed and executed an environmental sampling plan, met with township trustees and the local media, and proposed alternative designs to remediate the site or to have prevented the pollution from occurring in the first place. They were provided with base documents including government agency references, actual materials used by environmental consultants, legal papers, and tutorials covering the basic soils and geologic sciences needed to understand the site's setting. Students worked in teams on different aspects of the project, and interacted with the other student teams as they wrestled with the knotty problems involved in actual site investigations. The results were a series of design reports which were delivered to the township. The project provided a deeper understanding for the students of the environmental, political, and ethical constraints of engineering design.

2:30 INCREASING WOMEN'S PARTICIPATION IN SCIENCE: ACTION-WISE PROGRAM FOR ENCOURAGING WOMEN AND GIRLS IN SCIENCE, ENGINEERING, AND MATHEMATICS. John R. Marks[1], Jack Kovach[2], Evan Blumer[3], Sherry Hubbard[3], Susan Grubbs[4], [1]Muskingum Area Technical College, Zanesville OH 43701, [2]Muskingum College, [3]The Wilds, [4]Zanesville City Schools. jmarks@matc.tec.oh.us

The Action-WISE Program for Encouraging Women and Girls in Science, Engineering, and Mathematics, an $818,000, three-year program funded by the National Science Foundation, involves a close collaboration among four partners. The program links a two-year state technical college (Muskingum Area Technical College), a four-year private college (Muskingum College), a city school district (Zanesville City Schools), and a private wildlife research, conservation, and education center (the Wilds, formerly the International Center for the Preservation of Wild Animals) to provide an intensive and comprehensive science, mathematics, engineering, and technology (SMET) intervention program for grade 6 – 12 females. The project was inspired by the pioneering efforts of four teachers at Grover Cleveland Middle School in Zanesville: S. Grubbs, S. McFerren, L. Ferguson, and M. Denton, who developed a pilot project entitled the Women in Science and Engineering (WISE) program for female 7th and 8th grade students. Based on research indicating that adolescent females tend to lose interest in science and begin to rule out related work experiences at a time when they should really be exploring all career options open to them, the pilot program was intended to improve attitudes of female middle school students toward science and careers in science. The expanded Action-WISE program has: increased the annual numbers of students and teachers involved from 35 to over 100; added grade levels from 6th through high school; strengthened the WISE curriculum; expanded the project calendar to include an intensive summer science camp experience with a focus on environmental science activities for each of three grade levels (6th, middle school, and high school); developed a strong web of support for young women with an interest in SMET; and provided for the annual offering of a graduate level seminar for 45 area teachers and administrators on gender equity and current issues concerning women and girls in SMET.

2:45 THE IMPACT OF HONOR STUDENT INTERVENTION ON THE READING ABILITY OF SCHOOL AGED CHILDREN. Dianne A. Brown Wright and Margaret V. Koester, University of Akron, Dept. of Educational Foundations and Leadership, College of Education, Akron OH 44325-4206. dbrown-wright@uakron.edu

An outgrowth of the Clinton Administration's "America Reads Initiative," public school reading test results along with related literature and the notion of university-school collaborative partnerships provide the bases for this research project. Honor students from across the various academic disciplines received volunteer training and served as trained volunteers, reading to and with kindergarten through third graders in five different sites. Volunteer training provided focused on learning strategies, tutoring skills and pre- and post test administration. In addition to reading tutor training, each honor student reading volunteer was provided with both a university and site liaison for purposes of mentoring and support. Honor student volunteer as well as participating kindergarten through third grade demographics are provided. Pre- and post-test administration data were collected using story retelling quantitative analysis scores to determine the reading comprehension of pre-kindergarten through third graders' after twenty-five hours of reading volunteer service. Scores were based on the child's ability to recall parts of a story including story structure, plot, sequence, characters, theme, and resolution. Descriptive statistics (frequency distributions, means, standard deviations) and univariate inferential statistics (t-tests, correlation analysis, and chi square) were used to analyze data assessing the impact of volunteer intervention. Because of the pre-experimental nature of this research, however, no control group was used. Study results indicate that this PreK-3 Reading Initiative, using university honor students as reading volunteers, proved to be a positive, meaningful, and successful experience on the part of both the participating pre-kindergarten through third graders and university honor student volunteers, as well as individual site liaisons. In nearly every case, post-test scores demonstrate improvement over those found in the pre-test situation.

3:00 FACULTY DEVELOPMENT WITHIN THE CONSTRAINTS OF ACCREDITATION: PLIOT STUDY. Alan D. Smith, Robert Morris College, Dept. of Quantitative Sciences, Pittsburgh PA 15219-3099. smitha@robert-morris.edu.

Higher education has been the subject of increasing criticism in recent years for a variety of reasons. The usual response to this criticism is to start quality programs imposed by the college or an external entity. Accreditation is such an external entity and the mechanism of choice for may schools wanting to improve teaching and research. The purpose of this paper is to discuss several aspects of faculty development and its resistance to change as perceived through the viewpoints of AACSB standards. The results of a pilot study of a questionnaire of primarily faculty at a recent teaching economics conference for practicing and academic professional was used to record data on this topic. A questionnaire was established based on current literature on faculty development and motivational theories. The results demonstrated that faculty are very concerned on the aspects of such activity and are willing to move faster to achieve such training then previously thought. However, the motivations for such activity may be fundamentally different than those of the administration. AACSB cites that there must be a convictions-driven or internal motivational approach to faculty development. Many faculty feel that faculty development tends to focus on championing initiatives that only target appropriate scholarly outlets, such as scholarly/professional meeting venues and publications in order to demonstrate or justify

the appropriate academic credential classification purposes. In fact, it is perceived by faculty, based on this pilot study, that faculty are less resistant to change than their administrative counterparts.

3:15 A DISCOVERY LESSON IN EARTH SCIENCE FOR ELEMENTARY STUDENTS. Kenton E. Strickland, Wright State University Lake Campus, 7600 St. Rt. 703, Celina OH 45822-2952. kenton.strickland@wright.edu

An activity created for an upper elementary science and math day for gifted students evolved into a comprehensive discovery lesson in earth science. The activity involves a number of the primary and integrated process skills. Students are given a collection of fossils and are asked to make a table of measurements of length and width for each specimen in mm. They are then told to plot these measurements on a graph. Most students plot points, but some will make histograms. Graphs often exhibit bimodal distribution, clumping, or large variations. Students are then asked to analyze the graph. Student interpretations include different species, ontogeny, sexual dimorphism, or environmental factors. This simple exercise employs the primary process skills of observing, measuring, communicating, and recognizing number relations. Integrated process skills of formulating hypotheses and interpreting data are also utilized.

Engineering

03:45PM Saturday, April 1, 2000

Meyer Hall Room 122

Yung-Tse Hung - Presiding

3:45 OPTIMAL BASKETBALL STRATEGIES FOR THE FREE-THROW, THE LAY-UP, AND THE REBOUND. Ronald L. Huston, Cesar A. Grau, University of Cincinnati, Dept of Mechanical, Industrial, and Nuclear Engineering, P.O. Box 210072, Cincinnati OH 45221-0072. ron.huston@uc.edu

This paper discusses optimal strategies for three common basketball maneuvers. The strategies are based upon a dynamic analysis of the maneuvers which minimizes the kinetic energy needed for the maneuver. The analysis is motivated by the widely accepted premise that minimum energy expenditure provides for maximum control, thus increasing the probability of success of the maneuver. For the free-throw, the paper provides a listing of optimal launch angles and error bounds as a function of the vertical release position. For the lay-up, the beneficial effect of the backboard is studied. It is shown that the energy absorbed by the backboard increases the probability of a successful shot over that of a direct shot, without a backboard. Limitations of this backboard benefit are studied as a function of shooting position. Finally, for the rebound, the analysis shows that a player has a greater opportunity to make the rebound if he or she is moving at the time the errant ball is being shot. This strategy is shown to hold even if the player is moving away from the ball. That is, moving, even if in the wrong direction, is preferable to not moving at all when a rebound is about to occur. The analysis is based upon the principles of dynamics using MATLAB to obtain iterative solutions to the governing equations. Finally, the validity of the minimum energy expenditure premise is also discussed.

4:00 A NEW VENDING MACHINE LOCK. Christopher Dennison. (Dr. Janak Dave and Dr. Maria Curro Kreppel) University of Cincinnati, OMI College of Applied Science, 2220 Victory Pkwy, Cincinnati OH 45206. maria.kreppel@uc.edu

The primary device used for locking vending machines is known as a T-Handle. This locking mechanism has been used in The Coca-Cola System for the past twenty years, and remains the cheapest and most reliable lock used today. After spending six months in the employment of The Coca-Cola Company, I was able to see first-hand the impact a new lock design could have to increase vending machine security. The new design must achieve three primary objectives: (1) Increase security of the vending machine through means of a mechanical lock. The new design should prevent any real ease of break-in, while providing the same reliability if not more than the current design. (2) Reduce the time necessary to lock and unlock the vending machine. Ease of operation is always a concern since route drivers now spend a considerable amount of time twisting the T-Handle to secure the door. (3) Eliminate conventional methods of key entry. Both security and ease of operation will increase due to the elimination of standard keyholes, which provide a constant visual point of attack. A conceptual design has been approved for further development. This design incorporates both DC motor technology and alternative methods of key entry. Some twenty companies have provided the detailed information and formulas necessary to specify the DC motor type and application. Research has shown that "key entry" is quite versatile. I have decided to postpone further "key entry" research and development until the locking mechanism features are chosen.

4:15 TREATMENT OF METAL PRODUCT AND FINISHING INDUSTRY WASTEWATER BY ELECTROFLOTATION PROCESS. Yung-Tse Hung*, Mario G. Cora*, Howard H. Lo, Cleveland State University, *Civil and Environmental Engineering Dept, ** Dept of Biological, Geological and Environmental Sciences, Cleveland OH 44115-2440. Yhung@csvax.csuohio.edu**

This paper presents the development and optimization of an electroflotation unit for the removal of oil, heavy metals and organic compounds from oil-water emulsions containing 3.5% Nacl by weight. The objective was to examine the application of the mentioned technology within industrial wastewaters. Essential parameters in the electroflotation unit were hydraulic detention time, removal efficiency, and power consumption. The technique presents two major reactions schemes: adsorption and charge neutralization followed sweep coagulation. The electroflocculation unit consisted of an electrolytic cell with an aluminum anode and a stainless steel cathode. The unit was capable of treating 1 m3/hr oily wastewater in a continuous process. The unit achieved 65% oil separation at optimum conditions; 75% in the presence of NaCl (3.5% solution); and 92 % with the presence of NaCl and at optimum concentration of flocculant agent. Electrical consumption varied from 0.5 to 10.6 kW/m3. An empirical equation that relates the oil removal rates with the energy consumption was obtained with optimal operational current between 0.3 to 1.2 amperes. The electroflotation unit proved to be an effective treatment method for industrial oily wastewater containing high Nacl concentration. Other treatment method such as chemical treatment will be more costly due to high chemical requirement.

4:30 OLIVE MILL WASTEWATER TREATMENT USING ANAEROBIC DIGESTION FOLLOWED BY OZONATION PRETREATMENT. Yung-Tse Hung*, Garnel Olibris*, Howard H. Lo. Cleveland State University, *Civil & Environmental Engineering Dept, ** Dept of Biological, Geological and Environmental Sciences, Cleveland OH 44115-2440. Yhung@csvax.csuohio.edu**

Olive mill wastewaters (OMW) are produced from olive oil manufacture. Usually these effluents are disposed of into evaporation ponds or through public sewers. The disposal of these wastewaters may cause serious environmental problem due to the high NaCl and phenol concentration in the wastewaters. This paper examines the applications of a single anaerobic digestion of OMW. I in a process to remove COD (chemical oxygen demand) obtained and to produce methane. In an improved process, an ozonation pretreatment is performed to investigate the biodegradability of OMW by removing the phenolic inhibitors to enhance anaerobic digestion. The main chemical characteristics of OMW were pH 4.84, BOD (biochemical oxygen demand) 52 g/l, COD 112 g/l, VS (volatile solids) 9 g/l, and DVS (dissolved volatile solids) 4.65 g/l. In the single stage anaerobic process K_2HPO_4 and urea were used as nutrients in order to maintain satisfactory microbial activity (COD:N:P = 250:5:1). In the ozonation pretreatment process, orthophosphoric acid and sodium hydroxide were added to adjust the pH. In the anaerobic step, COD removal efficiencies up to 60% were obtained and methane production reached 194 ml/g COD removed. In the second step up to 70% COD removal were reached. The methane production reached 288 ml/g COD removed. The results show that OMW can be effectively treated by an anaerobic digestion process. The pretreatment of the OMW with ozone will remove phenolic compounds, which are the main causes of the toxicity to methanogenic bacteria of these wastes.

4:45 POTATO WASTEWATER TREATMENT USING ANAEROBIC, OXIC, AND ANOXIC REACTORS. Yung-Tse Hung*, Chatchawal Lerssupochawanich, *Howard H. Lo, Cleveland State University, *Civil & Environmental Engineering Dept, **Dept of Biological, Geological and Environmental Sciences, Cleveland OH 44115-2440. Yhung@csvax.csuohio.edu

The objective of this study was to study the effect of TOC (total organic carbon), NH_3 and phenol concentration on TOC removal of potato wastewaters. Experiments were conducted using anaerobic, oxic and anoxic reactors with hydraulic detention time of 6, 12, and 6 hours, respectively. Experiment conditions included 3 different TOC concentrations: 100, 550 and 1,000 mg/l; 3 different phenol concentrations: 10, 55 and 100 mg/l; and 3 different NH_3 concentration: 10, 55 and 100 mg/l. Results indicated that percent TOC removal was between 52-77% and percent NH_3 removal was between 20-40%. TOC of effluent concentration was between 23-477 mg/l and NH_3 of effluent concentration was between 8-144 mg/l. TOC was mainly removed in anoxic reactor and the percent removal was between 48-79%. NH_3 was mainly removed in oxic reactor and the percent removal was between 2-29%. The maximum TOC and NH_3 removal occurred when TOC was 100 mg/l and NH_3 was 10 mg/l. The result of this study showed that percent TOC removal decreased when TOC, phenol and NH_3 concentration increased. The initial concentration of ammonia also had effect on percent ammonia removal. When ammonia influent concentration increased, the ammonia removal in both anoxic and oxic reactors decreased.

Earth Science I

09:00AM Saturday, April 1, 2000

Meyer Hall Room 124

Mark J. Camp - Presiding

9:00 A COMPARATIVE STUDY OF THE USE OF COLUMBUS AND DUNDEE LIMESTONES AS BUILDING STONES IN THE TOLEDO REGION. Mark J. Camp, University of Toledo, Dept of Geology, Toledo OH 43606. mcamp@geology.utoledo.edu

Many northwestern Ohio buildings, bridges, and other structures constructed in the mid-1800s through the 1930s, incorporated blocks and slabs of gray to buff Middle Devonian limestones of the Columbus and Dundee formations. The stones are similar in the field; petrographic and paleontologic differences are minor. Searches show that detailed records were not maintained by many companies, records were destroyed over the years, and

former employees, who might provide oral histories, are fast disappearing. A knowledge of local history is the best key to determining stone sources. Sandusky was the largest supplier of Columbus limestone in northwestern Ohio; it was marketed as Sandusky bluestone. The city was a lakeport and connected to Toledo by railroad by 1853, providing transportation for large volumes of stone. Quarries at Marblehead also supplied Columbus Limestone hauled a few miles to a railroad station or shipped by boat. Reportedly Marblehead stone was used along the Miami and Erie canal across northwestern Ohio. The Dundee limestone came from quarries at Whitehouse chartered when the Wabash Railroad opened in 1855. A direct link was opened to Toledo where the railroad used the stone for foundations and docks at its terminal. During the Depression these railroad structures were salvaged to help in the erection of buildings at the Walbridge Park Zoo by WPA tradesmen. The Zoo is the ultimate example of mixing of these stones since Columbus Limestone was also recycled from the adjacent Miami and Erie canal. Due to volume produced, marketing, and superior transportation of the Sandusky firms, Columbus Limestone was more widely used than the Dundee.

9:15 ABANDONED DEEP COAL MINE WEB SITE. Ann G. Harris, Youngstown State University, Dept of Geology, One University Plaza, Youngstown OH 44555-0001. agharris@cc.ysu.edu

For the last twenty plus years there has been a problem of abandoned deep coal mines in Ohio that have been either caving in or creating problems for new and old construction. For the average person there was no central location to obtain available information on these mines. Location maps and mine maps have been available from the Ohio Geological Survey since 1979 but not a great deal of information on the individual mines. The web site (http://www.as.ysu.edu/~geology/) of the Youngstown State University Geology Department is beginning to address this problem. Three counties are now available; they are Trumbull, Mahoning and Columbiana Counties. Additional counties will be added. To use the web site the individual first selects the desired county from a master map that shows all three counties and the general location of the mines. Next the township map is pulled up which gives the location and name of all the located mines in that township. Click onto the mine name and a data sheet will appear. If there is a mine map available it will be indicated and it will be possible to view a copy of a scanned mine map. At the present time information on the unlocated mines has not been included. For additional or more detailed information, contact Ann G. Harris of the Youngstown State University Geology Department.

9:30 WATER, GEOLOGY, AND MULTIMEDIA EDUCATION: A CD-ROM PROGRAM. Elizabeth A. Barnett, Garry D. McKenzie, and Frank W. Schwartz, Ohio State University, Dept. of Geological Sciences, Columbus Ohio 43210-1398. McK+@osu.edu

The purpose of this project is to design a multimedia educational tool for introducing undergraduates and high school students to basic concepts in hydrogeology, with a focus on geology and hydrology in Ohio. Creation of a CD-ROM product and a proposed web-based version involves research, collection of materials, writing, editing, testing, production, and distribution. Rapid changes in computer software and the shift toward web-based media also require an investigation of new tools for maintaining and updating the product into the future. Despite great advances in the field of hydrogeology in the past 50 years, public knowledge of groundwater issues is often deficient, even among those with higher education. Increasing awareness of groundwater and surface water issues among students in high schools and introductory geology courses can promote interest in the geological sciences in Ohio universities and colleges, and help to create an informed public, more capable of understanding water pollution and resource availability issues. Topics in the CD-ROM include: geology of Ohio, the hydrologic cycle, Ohio water resources, basic hydrogeological concepts, and water resource issues including water law, and water pollution, with case studies. Pollution case studies are mostly drawn from Ohio sites, including examples for raw sewage, saltwater, hazardous waste, nuclear waste, agricultural, and deep-well injection pollution issues. As revision of materials and testing continue, the project has shown the importance of software development tools that produce multimedia products that may be easily upgraded and transferred between formats, and the difficulty of part-time development in the university setting.

9:45 A CLASSIFICATION OF DIGITAL GEO-REFERENCED DATA. Robert L. Vertrees. Ohio State University, School of Natural Resources, 210 Kottman Hall, 2021 Coffey Rd, Columbus OH 43210-1085. Vertrees.1@osu.edu

The author chairs the Data Sources and Contacts Task Force (DS&CTF) of the Ohio Geographically Referenced Information Program, a State-of-Ohio agency that furthers the development, coordination, and application of digital geo-referenced data. The DS&CTF is: (1) inventorying data sets and holdings applicable to Ohio of public- and private-sector organizations, and (2) gathering metadata (data about data sets) into an automated clearinghouse. The author developed the classification: (1) to categorize data sets (a type of data for which at least some metadata have been developed); (2) to study patterns among types of data for which metadata have not yet been developed but that are included in holdings; and (3) to identify where gaps exist in the availability of data. This 11-category scheme includes the following sequence of categories: (1) two categories (about geodetic control and base maps) pertain to the functional needs of developing a data base; (2) two categories (that include data about topics such as elevation and geographic names) do not fit into subsequent categories but can be associated with topologically related features of a base map; (3) two categories are about land use/land cover and land ownership; (4) three categories primarily pertain to data about other cultural, socio-economic, and demographic aspects of society, and (5) two categories primarily pertain to natural resources and the environment. Individual features of some complex maps are mentioned along with the parent map and are also placed into other appropriate categories. An up-to-date synopsis is given of the extent to which the DS&CTF has used the classification to identify data patterns and gaps. Some potential applications of the classification beyond the DS&CTF are also discussed.

10:15 WEST VIRGINIA RECORD 24-HOUR SNOWFALL AT FLAT TOP, 27-28 JANUARY 1998. Thomas W. Schmidlin, Kent State University, Dept of Geography, Kent OH 44242. tschmidl@kent.edu

A storm on 27-28 January 1998 gave a reported 35.0 inches (88.9 cm) of snow in 24 hours at Flat Top, West Virginia, exceeding the previous state record 24-hour snowfall of 34 inches at Bayard on 27-28 April 1928. The objective of this research is to place the event in a meteorological and climatic perspective and assess the validity of the reported record. Sources included government data, news accounts, and a site visit. The strong coastal storm caused excessive snowfall in the higher elevations of the central Appalachians, widespread disruptions to travel and electric power, and damage to property and trees. Flat Top is an official cooperative observing site with equipment supplied and maintained by the National Weather Service (NWS). A NWS employee made the estimate of 35 inches in 24 hours based on a measurement of 30 inches in the first 21 hours of the storm and 8 inches in the next 7 hours. The 35 inches of snow in 24 hours at Flat Top is discussed as a possible new 24-hour snowfall record for West Virginia.

10:30 SPATIAL CONCENTRATIONS OF POPULATIONS AND THE ENERGY BASIS FOR ECONOMIC GROWTH. Richard W. Janson, The Janson Industries 1200 Garfield Ave. S.W., Canton OH 44706. janson01@aol.com

Five great regions of earth's land surface have concentrations of population that are remarkable. Each of these great regions has areal extension that exceeds 500,000 square miles. The commonalities among nations with massive population is one object of the inquiry. Several approaches were used to clarify some of the necessary independent variables required to explain the phenomenon. Chief among the explanatory variables is the climate. The 20 largest (population) megacities were studied to determine the association with climate. Also several pairs of nations with large populations were compared on the basis of per capita consumption of primary energy inputs and per capita gross domestic product. This method was used to establish the relative wealth real income of the nations. Several nations with huge populations located outside favorable climate regions were used in the comparisons to emphasize the low per capita real incomes and the difficulty of achieving satisfactory economic growth trajectories. There is a clear association between regions of massive population and climate, providing there is a hinterland of moderate gradients and cultivable soil. Per capita real income of these great regions vary widely and is primarily a function of per capita consumption of energy inputs.

10:45 ENERGY POLICY IMPLICATIONS COMPARING RESULTS USING LEAST SQUARES METHODOLOGY AND NEURAL NET METHODOLOGY. Richard W. Janson[1] and Lala B. Krishna, [1]The Janson Industries, 1200 Garfield Ave. S.W., Canton OH 44706 and University of Akron. janson01@aol.com

Seven scenarios of profound economic consequence are subjected to analysis. Implications of legislative and/or regulatory decisions to subsidize coal usage, or alternatively to tax coal usage by power plants or to expand nuclear power production, or to eliminate nuclear plants are typical of the scenario assumptions. Implications using a least squares predictive equation are compared to implications using a neural net that was computed and published earlier. The data used in each case is the same. Input data consist of primary consumption of coal, natural gas, petroleum, nuclear, and hydro energy inputs. Twelve outputs track the consumption of coal, gas, petroleum, and electricity among three using sectors—residential and commercial, industrial, and transportation. The scenarios also include assumptions such as the expansion of energy usage over time, and the presumption that U.S. population will be 500 million by year 2050. The importance of understanding policy implications is underlined by two realizations. The standard of living of every single American is based on the consumption of 1,000,000 Btu per day, more or less, measured as primary energy inputs (largely fuel inputs). Also, the two most populous nations in the world are rapidly industrializing. The results of both methodologies are consistent and therefore the implications are the same. The advantage of using both methodologies is to confirm results, especially in turbulent waters of macro economics with very significant policy implications.

EARTH SCIENCE II
01:30PM SATURDAY, APRIL 1, 2000
MEYER HALL ROOM 124
C. SCOTT BROCKMAN - PRESIDING

1:30 Division Business Meeting

2:00 LATE PRECAMBRIAN EVENTS ON EARTH: POSSIBLE LUNAR INVOLVEMENT. Robert J. Malcuit, Dept of Geology-Geography, and Ronald R. Winters, Denison University, Dept of Physics-Astronomy, Granville OH 43023. malcuit@denison.edu

The Late Precambrian appears to be a critical time in the history of the planet. There are two major horizons of glacial deposits in the more complete sequences and each of the glacial sequences is capped by a significant thickness of stromatolitic carbonates. These features have been interpreted by many investigators as recording alternating "icehouse" and "greenhouse" episodes in a low paleolatitude setting. Many of the glacial-carbonate sequences are several hundred meters thick and are thought to be rift basin fills. Another noteworthy feature of Late Precambrian sequences is the association of tidally influenced sediments including significant thicknesses of tidal rhythmites. The Late Precambrian also appears to be a critical time in the history of the lunar orbit. Peale and Cassen (1978,Icarus,36, p 245) identified an orbital resonance state between jupiter's orbit and the lunar orbit when the lunar orbit is at 53.4 earth radii. They state that if the resonance is stable, then there could be "profound" effects on both the earth and moon. We have done some 4-body (sun, earth, moon, jupiter) numerical simulations (fourth-order Runge-Kutta integration procedure) on the effects of this resonance. In the short (100-year) runs that we have done on both circular and elliptical lunar orbits with semimajor axes between 50.0 and 53.4 earth radii, we have found a notable increase in orbital eccentricity. In general, a geologically short-lived excursion in lunar orbit eccentricity could explain the abundance of tidally influenced sediments of that time and the enhanced rock tides could have an ancillary influence on the development of continental rift zones.

2:15 OF ROCKS AND ECONOMICS: THE GEOLOGY OF THE MARION, OHIO, 30 X 60 MINUTE QUADRANGLE. Douglas L. Shrake, ODNR Division of Geological Survey, 4383 Fountain Square Dr, Columbus OH 43224-1362. doug.shrake@dnr.state.oh.us

A cooperative effort between the Ohio Division of Geological Survey and the U.S. Geological Survey produced the 1997 regional bedrock-geology map of the Marion, Ohio, 30 x 60 minute quadrangle (scale 1:100,000). Comparing the 1997 map to the same area on the 1920 bedrock-geology map of Ohio shows significant differences. These differences result from analyses of field observations, measured stratigraphic sections, water-well drillers logs, and geophysical logs and descriptions from water and oil and gas wells. The Ohio Geological Survey cored and geophysically logged two sites, one near Ada and the other near Bucyrus, to determine the stratigraphy of the area. These data facilitated the correlation between geophysically logged water or oil and gas wells. Drafting the geologic contacts at a scale of 1:24,000 enhanced the resolution of structural features. Structural features present include faults, the Findlay Arch, and a portion of the Appalachian Basin. A high degree of correlation exists between these structural features and known oil and gas fields. The dominant trend of these fields is SW-NE; however, there appears to be a secondary SE-NW trend; perhaps future exploration will determine if there are additional SE-NW fields. In addition to hydrocarbon production, mining operations in the map area produce dolostone, limestone, clay, and sand and gravel. Although not present in economic quantities, sulfide-based minerals occur in the map area.

2:30 SURFACE MINE SPOILS; WEATHERING RATES AND LANDUSE CAPABILITIES. James R. Bauder, 6106 Armistice Avenue NW, Canton OH 44718. james.bauder@worldnet.att.net

For nearly forty years as a soil scientist and geologist, numerous observations and experiences with surface mine spoils have revealed a wide range of weathering profiles and potential land uses for differing surface mine spoils. The evolution of perceptions concerning surface mine spoils range from early impressions that surface mine spoils were basically wastelands to the present reclamation of prime agricultural soils by replacing each horizon in sequence. Soil development within the various spoils is the result of the highly variable rates of weathering. The rates of weathering are the result of differing soil forming processes. Effective hydraulic conductivity of the spoil is apparently the most important factor in Northeast Ohio. The wide range of soil formation rates within the spoils have resulted in numerous weathering profiles that have varying capabilities for differing land uses. The spoils with the widest range of suitable land use capabilities are the older "unreclaimed" spoils; while spoils with more recent reclamation procedures, result in a narrower range of capabilities for efficient land uses.

2:45 INTERPRETATIONS OF THE GEOCHEMISTRY OF AN ACID-CONTAMINATED STREAM IN CENTRAL OHIO. Linda M. Centeno and Gunter Faure, Ohio State University, 170 Mendenhall Laboratory, 125 South Oval Mall, Columbus OH 43210 centeno.6@osu.edu

Abandoned and reclaimed coal mining areas over 30 years old still present problems of high acidity and metal contaminants in stream waters. This is a potential health hazard for humans and animals who drink this water. The site of the present study is Lexington Creek in Perry County, Ohio. Lexington Creek is a tributary of Rush Creek, which flows into the Scioto River. Chemical analysis of the water and the suspended sediment were interpreted to determine how the sediment load and metal concentrations vary downstream. The results indicate the presence of three components: acid-mine drainage (AMD), groundwater, and meteoric water. The abundances of AMD along the course of Lexington Creek, determined from the triangle of mixing, range from less than 10% at the head of the creek to more than 25% at its mouth. The abundance of the groundwater component increased downstream and reached about 65% at the confluence with Rush Creek. The pH of the water in this drainage basin ranges from 2.6 to 6.2. In addition, the suspended sediment consisting primarily of ferric hydroxide reaches a concentration of 180 mg/L. This compound sorbs anions at low pH and cations at high pH, thereby altering the chemical composition of the water. Nevertheless, our data show that Lexington Creek is impacted by AMD several decades after strip mining has ceased.

3:00 A RE-ANALYSIS OF USGS REPORT 95-4194 CONCERNING THE GROUND WATER AVAILABILITY IN GEAUGA COUNTY. George W. Collins II, Case Western Reserve University, Dept of Astronomy, 10900 Euclid Ave, Cleveland OH 44106-7215. Collins@Grendel.Astr.CWRU.EDU

Jagucki and Lesney (1995) concluded in the USGS REPORT 95-4194 that while 70% of water level in the wells of the county had declined during the interval between 1987 and 1994, that the decline cannot be traced to changes in the population and the primary cause seemed to be a decline in the recharge rate of the aquifer during the study period. Their result was based on the failure to find a statistically significant correlation between the decline in the wells and the population growth in the county during that period. We use regression analysis to re-analyze their data separating the county into two separate aquifer re-supply zones. We find that there is a significant difference in the water level declines in wells between the eastern part of the county drained by the Cuyahoga River and the western part which, when correlated with population growth accounts for the small value of the correlation coefficient found by Jagucki and Lesney (1995). Further regression analysis of the water level declines for well s sampling the four primary aquifers in the county show statistically significant correlations of water level decline with population growth in the aquifers associated with the Pottsville formation in both the eastern and western parts of the county. However, only the some aquifers show statistically significant decline which Jagucki and Lesney (1995) attribute to a decline in the recharge rate probably due to a decline in precipitation between 1987 and 1994. We suggest that the magnitude of the decline in those aquifers recharged by the Cuyahoga River warrant further hydrological study to determine an explanation for their decline.

3:30 ROOT CHANNELS AND MICROBIAL PRECIPITATES IN SUBSURFACE FRACTURES WITHIN GLACIAL TILLS OF OHIO. Ann D. Christy and Margaret J. McMahon, Ohio State University, Dept. of Food, Agricultural, and Biological Engineering and Dept. of Horticulture and Crop Science, Columbus OH 43210. christy.14@osu.edu

Fractures and joints are common in Ohio's glacial till deposits. The more permeable fractures allow preferential root penetration beyond what would be expected in unfractured parent tills. Roots have been observed growing within till fractures at test pits and streamcuts in Franklin, Madison, Clark, and Clermont Counties in Ohio. Greyish-white, powdery calcium carbonate (calcite) coatings on the walls of the fractures and partially decomposed roots within some of the calcite-filled fractures were observed at the Madison county site. Microbial action upon living roots and dead root material can lead to calcite precipitation and infilling of the fractures. Initially roots grow into and fill the fracture. Eventually the root dies, and aerobic fungi and bacteria decompose the dead roots. These fungal fibers become calcified and/or calcium oxalate crystals grow as a metabolic byproduct on fungal hyphae. Certain aerobic soil bacteria decompose calcium oxalate and cause direct precipitation of calcite. As bacteria exhaust the available oxygen and the fracture becomes anaerobic or the nutrients are completely consumed, the fungi die and anaerobic bacteria then decompose the remains including the calcified fungal fibers, leaving the original fracture filled or lined with semi-soluble calcite.

3:45 AN EXPANDABLE DESIGN OF SOILS/GEOLOGIC TEST PITS FOR ENVIRONMENTAL INVESTIGATIONS OF FRACTURED GLACIAL TILLS. Ann D. Christy and Louis A. McFarland, Ohio State University, Dept. of Food, Agricultural, and Biological Engineering, Columbus OH 43210. christy.14@osu.edu

Environmental investigations in glacial settings can be enhanced by the construction of soils/geologic test pits which allow investigators to evaluate the presence, extent, and density of subsurface fractures. An expandable design allows a pit of any depth to be constructed by benching or stair-stepping the sidewalls until the desired depth is achieved. The dimensions of these benches, 1-meter deep and 1- to 2-meters wide, allow site investigators to trace fractures in a 3-dimensional view while meeting OSHA excavation safety requirements. The proposed 4-meter deep test pit design can be used for 1-meter, 2-meter, or 3-meter deep test pits by sequentially eliminating the shallower benches from the design. Ramps on one or more sides may be included to facilitate entry by wheeled vehicles or other equipment. Once the pit is constructed and the exposed faces are painstakingly prepared, further analyses can be performed including in situ tests of hydraulic conductivity in fracture-affected and non-fractured zones, grain size analyses and mapping on the USDA textural triangle, geotechnical lab tests of small sample cores, clay mineralogy identification of fracture-affected and non-fractured samples, in situ dye tracer studies, and density measurements of fractures, earthworm burrows, and root channels at various depths.

Physical Science
04:15PM Saturday, April 1, 2000
Meyer Hall Room 124
Josefina De Los Reyes - Presiding

4:15 MORPHOLOGIC STUDY OF SICKLED ERYTHROCYTES. Florencia Pauli (Dr. H. Westcott Vayo). University of Toledo, 2801 W. Bancroft, Toledo OH 43606. fpauli@uoft02.utoledo.edu

In sickle cell anemia, the red blood cells contain an abnormal type of hemoglobin caused by abnormal beta chains of the hemoglobin molecule. When this hemoglobin is exposed to low concentrations of oxygen, it precipitates into long crystals that give the erythrocytes a sickled or otherwise abnormal appearance. The precipitated hemoglobin also damages the cell membrane making the cells very fragile and leading to severe anemia. The purpose of this research is to identify some sickled erythrocyte shapes and describe mathematically their surface area and volume using the techniques of calculus. Important functions of normal cells are oxygenation, diffusion, and membrane deformation; these depend, in part, on the surface area to volume ratio of the cell. The surface areas and volumes of these sickled cells could be compared to normal cells to assess their functionality. Sickled cells are thought to have different surface area to volume ratios than normal cells and thus it is extremely important to investigate the surface area to volume ratios of these cell types. The cells chosen for this study are all of the "flat" type, not rotationally symmetric, and will be presumed to have a common thickness t_0. The types of cells studied thus far are named deltoid, astroid, and hypocycloid, as these are the plane curves that best represent their profiles. These derived results for surface areas and volumes give rise to certain parameters which can later be used for surface area, volume, and surface area-to-volume ratios for these cell types. Measurements of actual cells can be performed by using a light microscope monitor system. This study could help classify cells and explain the "why" of sickling relative to geometric considerations.

4:30 MOLECULAR DYNAMICS SIMULATION OF RNA FRAMESHIFTING PSEUDOKNOT. Kristina E. Csaszar (Dr. Neocles B. Leontis), Bowling Green State University, Chemistry Dept, Bowling Green OH 43403. csaszkr@bgnet.bgsu.edu

The structural dynamics and solvation of an RNA frameshifting pseudoknot from Beet Western Yellows Virus (BWYV) were investigated using molecular dynamics (MD) simulation methods. The simulations were carried out using the programs in the AMBER 5.0 package, with explicit solvent and counterions (Na+) and accurate treatment of long-range electrostatic interactions (Particle-Mesh Ewald method). The pseudoknot structure is of particular interest because it contains four of the six possible shallow-groove interactions that have been identified on theoretical grounds (Leontis and Westhof, 1998, *Quart. Rev. Biophys.* 31:399-455), as well as a protonated C(+)•G trans Watson-Crick/Hoogsteen pair. Starting with the crystal coordinates for this molecule, multiple MD simulations were carried out to explore the stabilities of these pairings and the solvent and counterion dynamics (Su, L. , L. Chen, M. Egli, J. M. Berger, and A. Rich, 1999, *Nat Struct Biol.* 6:285-92). Each simulation consisted of four stages of minimization and MD equilibration followed by the unrestrained production run. The following observations were made: All of the noncanonical basepairs referred to above are stable during two hundred picoseconds of simulation using N1-protonated C8 (they are not retained if C8 is not protonated). Also, retention sites for both water and sodium ions have been located in repeated simulations, with water participating directly in some of the base pairs. Further work is currently being done with longer simulations (one nanosecond or more) to see if these interactions are still stable over a longer time scale.

4:45 COMPUTER GENERATION OF MAGIC SQUARES USING MINITAB®. Josefina P. De Los Reyes, University of Akron, Dept. of Statistics, Akron OH 44325-1913. jdelosreyes@uakron.edu

The purpose of this paper is to present a computer method of generating a magic square using MINITAB®, a statistical software. A magic square of order n is an nxn array of the integers 1,2, ..n^2 so that the sum of entries in the n rows, n columns, and 2 main diagonals is a constant. Amid fascinating recreational aspects of magic squares and theoretical questions asked about a matrix when a magic square is regarded as such, two ideas in particular caught this author's interest while writing this paper. One idea is from a problem (book on finite fields) to construct a magic square of order n from two orthogonal Latin squares of order n with entries in (0,1,..., n-1) if the sum of entries in each diagonal of the Latin squares is n(n-1)/2. Is this procedure reversible - can orthogonal Latin squares be obtained from a magic square? Initial results obtained by this author show that given a magic square and a Latin square, another Latin square that is orthogonal is derivable. General results are still under investigation. Latin squares are a type of statistical experimental designs, a very interesting fact being that sets of mutually orthogonal Latin squares are closely related to algebraic and geometric structures. The second idea (article in electronic engineering) is about the effectiveness of a dithering algorithm that is based on a 3x3 magic square over that based on a "direct" dithering algorithm. Briefly, dithering is a printing technique that allows a printer, inherently capable only of producing a limited set of discrete color dots, to produce the continuous tones for high quality color printing. The color algorithm is built by filling the squares of the image region in the numerical order of a magic square with discrete color elements up to the square with a value equal to the shade required, and leaving the remainder white or another color. This author is inspired that perhaps a similar procedure utilizing magic squares of higher order might work for the television and internet screens. Initially, laying out the algorithm involved trial and error; later some patterns appeared and checked out. Proving that rows, columns, and diagonals had the same sum was accomplished while writing the macros, the equivalent of a computer program in MINITAB® language. A different approach to generate the magic square was needed for each of three cases which cover the possible values of the order n of the magic square: (1) n is odd as in 3,5,7,... (2) n is an even number that is twice an even number as in 4,8,12,16,... (3) n is an even number that is twice an odd number as in 6,10,14,18,....

Experimental Physiology: Basic
09:00AM Saturday, April 1, 2000
Meyer Hall Room 114
Mary D. Gahbauer - Presiding

9:00 EFFECTS OF DIETARY EXPOSURE TO 3,3', 4,4'-TETRACHLOROBIPHENYL (PCB77) ON CHOLINE ACETYL TRANSFERASE ACTIVITY, AND SPATIAL LEARNING AND MEMORY IN 30-DAY-OLD RATS. Christa L. Bowen, Terri L. Provost, and Lee A. Meserve, Bowling Green State Univerisity, Dept. of Biological Sciences, Bowling Green OH 43403. cbowen@bgnet.bgsu.edu

Polychlorinated biphenyls (PCB) are environmental contaminants that were first observed as a problem after about 40 years of industrial use. Placental and lactational PCB exposure to offspring cause metabolic and endocrine disruptions including depressed body weight, hypothyroxinemia, spatial learning and memory deficits, and neurochemical and neurobehavioral alterations. Previous work has shown that a mixture of PCB congeners resulted in smaller offspring, problems with spatial learning, and alterations in choline acetyltransferase (ChAT) activity. The present study concentrated on one specific coplanar congener of PCB. Pregnant female Sprague-Dawley rats were exposed to either a control diet (consisting of rat chow) or a treatment diet (consisting of standard chow with PCB 77 added at 1.25 ppm (LPCB) or 25 ppm (HPCB). Offspring were tested for learning and memory via a Morris water maze, and ChAT sctvity was measured radiometrically. This study has shown that dietary exposure of 30-day-old-rats to LPCB and HPCB during gestation, lactation, and post-weaning diet elevated ChAT activity in the hippocampus and basal forebrain. Three groups per litter of rats were tested for 10 trials in a Morris water maze on days 20-24 for learning ability. The latency times to the platform were longer for controls than either PCB groups. After training, rats were assigned to either a memory group or one of two relearning groups. On day 29, the memory group rats were placed in the maze, and the control animals demonstrated longer latency than the PCB groups. Relearning was done on days 25-29, and involved either finding the platform after it was placed in a new position, or finding the platform from a new release point. The control groups took longer to relearn the water maze task than did the PCB exposed groups. These results show that ChAT activity and behavior are altered by PCB.

9:15 TESTOSTERONE EFFECTS ON CARDIAC FUNCTION IN THE MALE SPONTANEOUSLY HYPERTENSIVE RAT (SHR). Christin Spahn, Michael Herman, Gail Dunphy, Daniel Ely, University of Akron, Dept. of Biology, Akron OH 44325-3908. chrisspahn@hotmail.com

Males have a greater incidence of hypertension than females and one reason may be how testosterone(T) affects cardiac function. The objective of this study was to determine the effect of T on the contractility of rat hearts to see if it improves left ventricular (LV) function. Male SHR rats were castrated and implanted with either sham implants (n=9) or testosterone (n=9). The isolated hearts were perfused using the Langendorff technique. LV pressure was assessed at three balloon volumes (bv, 0.05, 0.10, 0.15 µL) and subsequent norepinephrine (NE), and lactic dehydrogenase (LDH) perfusate samples were collected. The presence of T increased the systolic pressure (SP) at the 0.15 µL bv with a correlation of ($r=0.56$, $p=0.01$) and decreased the diastolic pressure (DP) at the 0.05 µL bv ($r=-0.478$, $p=0.04$). NE release was inversely related to SP at the 0.10 µL ($r=-0.52$, $p=0.02$) and 0.15 µL ($r=-0.67$, $p=0.002$) volumes. Conversely, NE release was associated with increased DP at the 0.05 µL ($r=0.62$, $p<0.005$) and 0.15 µL ($r=0.50$, $p=0.03$) bv. In comparing the two groups T versus sham, T produced significantly higher SP at 0.10 µL ($p=0.027$) and 0.15 µL ($p=0.029$) volumes. In contrast, T produced depressed diastolic pressures at the 0.05 µL ($p=0.0417$) volume. Coronary flow in the T group was significantly higher than sham before ($p=0.02$) and after ($p<0.01$) pressure recordings. LDH values showed no significant differences in tissue damage in either group. In conclusion, T appears to beneficially increase SP and decrease DP; however, NE release produced the opposite results and was harmful, possibly by increasing vascular permeability.

9:30 THE EFFECTS OF MATERNAL EXPOSURE TO POLYCHLORINATED BIPHENYLS ON THYROID HORMONES AND INSULIN-LIKE GROWTH FACTOR-1 IN 15 AND 30-DAY-OLD SPRAGUE-DAWLEY RAT PUPS. Terri Provost, Laura Juárez de Ku,

M. Sue Houston, Lee A. Meserve, Bowling Green State University, Dept. of Biological Sciences, Bowling Green OH 43403. pterri@bgnet.bgsu.edu
Polychlorinated biphenyls (PCB) are ubiquitous environmental toxins that bioaccumulate and are slow to environmentally degrade. Exposure to these contaminants gestationally and lactationally in humans and in animal models has been found to cause congenital deformities, hypothyroxinemia, epidermal abnormalities, low birth weight, growth retardation, and deficits in cognitive and motor function. The cause of low birth weight and growth retardation could be caused by many mechanisms. The present study investigated the effect of maternal low concentration (1.25 or 12.5 ppm) PCB exposure (Aroclor 1254 ®) during gestation and lactation on growth related parameters. Thyroxine (T_4), triiodothyronine (T_3), and insulin-like growth factor-1 (IGF-1) were measured radiometrically in serum of 15 and 30-day-old Sprague-Dawley rat pups. In 15-day-old pups T_4 showed a trend towards elevation in those exposed to 1.25 ppm and significant depression in 12.5 ppm exposed animals when compared with same aged controls. Thyroxine was depressed in animals exposed to both treatment groups at 30 days of age, although significantly only with 12.5 ppm exposure. Fifteen-day-old animals had serum T_3 concentrations near those of controls. However, 30-day-old pups form both treatment groups had significantly depressed T_3 concentrations. Serum IGF-1 was significantly depressed at 15 days of age and elevated (significantly in 12.5 ppm) at 30 days of age in both treatment groups compared to same aged control animal concentrations. These results suggest there are no direct correlations between alterations in thyroid hormone status and IGF-1 status by PCB exposure.

9:45 TESTOSTERONE INCREASES RENAL ELECTROLYTE ABSORPTION AND CONTRIBUTES TO A RISE IN BLOOD PRESSURE IN SHR/Y AND WKY RATS. Traci L. Warner, Gail Dunphy, Dan Ely, University of Akron, Dept. of Biology, Akron OH 44325-3908. twarner@uakron.edu
Studies have related testosterone (T) levels to hypertension and suggest T may influence renal sodium excretion. The hypothesis tested in this study was that T increases sodium reabsorption and blood pressure (BP) in three strains of male rats – SHR (spontaneously hypertensive), WKY (normotensive), and SHR/y (slightly hypertensive - SHR Y chromosome inserted into a WKY background). Three treatments were used: control (n=8/group), castrate (n=6), and castrate + T (n=6). T was implanted biweekly into castrates from 8-14 weeks. BP was measured biweekly from 7-15 weeks of age via tail cuff. Throughout the experiment, male SHR BP was significantly higher than both SHR/y and WKY controls ($p<0.01$), and SHR/y BP was significantly higher than WKY control ($P<0.05$). BP of SHR and WKY castrate + T was significantly higher ($p<0.05$) than their corresponding castrates. Plasma T was analyzed biweekly and Ca and P at 15 weeks. Urine collections (24h) were performed at 15 weeks for electrolyte determination. Castration significantly increased excretion of Na, K, and Ca in both the SHR/y and WKY rats as compared to controls ($p<0.001$). K excretion of SHR/y castrate (0.0812 mmol/hr/100g body weight) and WKY castrate (0.0983 mmol/hr/100g body weight) was also significantly different ($p<0.05$). T normalized electrolyte excretion to control values. Castration significantly increased P excretion in WKY compared to SHR/y, and T normalized this effect. T appears to play an important role in renal electrolyte excretion, which may have an influence on BP. This role appears to be strain specific for the SHR/y and WKY.

10:00 THE EFFECTS OF SYMPATHETIC NERVOUS SYSTEM (SNS) STIMULATION ON BLOOD PRESSURE AND TESTOSTERONE LEVELS IN NEONATAL NORMOTENSIVE AND BORDERLINE HYPERTENSIVE MALE RATS. James P.Pinette, Gail Dunphy and Daniel L. Ely, University of Akron, Dept. of Biology, Akron OH 44325-3908. jpinette@aol.com
The objective of this study was to determine the effects of neonatal nerve growth factor (NGF) and its possible influence on plasma catecholamines and testosterone upon blood pressure (BP). Two strains of rats: normotensive Wistar Kyoto (WKY) and a borderline hypertensive strain genetically similar to WKY but having a Y chromosome from a genetically hypertensive father (SHR/y) were used. To increase SNS activity, nerve growth factor (1.34mg/l of NGF/ 7g of body weight) was injected daily into neonatal WKY (n=6) and SHR/y (n=6) pups days 1-21. The control groups, WKY (n=6) and SHR/y (n=6), were injected daily with isotonic saline. Body weight, BP (tail cuff), plasma catecholamine (High Pressure Liquid Chromatography) and serum testosterone (T, by Radioimmunoassay) levels were measured weekly. A significant increase in BP was seen in the WKY pups during weeks 5-7 and 9-11 (33mmHg, $P< 0.0001$). The SHR/y pups also showed a significant increase in BP over the first three weeks (31mmHg, $P= 0.0166$). Preliminary T data indicates that SHR/y NGF treatment groups had nearly three times the level of serum T compared to that of the WKY treatment group ($p=0.0152$). A positive correlation was seen when comparing testosterone levels and BP ($r=0.56239$, $p=0.00423$). No consistently significant differences were seen in plasma catecholamine levels. In conclusion, NGF treatment caused a significant increase in systolic BP in both normotensive and borderline hypertensive rat strains. T differences between the strains may be the mechanism for the BP effect (supported by HL-48072-6).

10:15 EPIGENETIC MECHANISMS IN HYPERTENSION: IS ESTROGEN INVOLVED? Bradey T. Kleman (Dr. Amy Milsted), University of Akron, 18870 Rd 20-P, Fort Jennings OH 45844. brady@uakron.edu
The pattern of methylation varies with age in the androgen receptor gene in SHR/y and WKY female rats. While methylation is not a mutation, the pattern of methylation is passed onto succeeding generations. It has been shown that while SHR/y and WKY female rats should be genetically identical, they exhibit different phenotypes, as we described previously (Milsted et. al, 1998 J. Hypertens. 16:823-828). We looked at whether or not ovariectomy affected the pattern of methylation in the DNA that encodes the androgen receptor gene. Our hypothesis is that an ovariectomy will not further alter the methylation patterns in DNA. Genomic DNA from livers of six ovariectomized WKY and six ovariectomized SHR/y females was isolated and compared with DNA of six intact females of each strain. DNA is digested with *Ava* II, and Southern blot analysis performed to reveal any differences in site-specific methylation among the samples. These differences in methylation may be a key control mechanism of hypertension and may help us better understand why males and females respond differently to hypertension treatments.

Experimental Physiology: Clinical

02:00PM Saturday, April 1, 2000

Meyer Hall Room 114

Judy Adams - Presiding

2:00 THE PHARMACODYNAMIC CHARACTERIZATION OF AN ANTISENSE OLIGONUCLEOTIDE AGAINST MAO-B IN THE RAT BRAIN. Kevin Haynes, Travis J. Worst, Michael D. Kane, and Jon E. Sprague, Ohio Northern University, The Raabe College of Pharmacy, Dept of Pharmaceutical & Biomedical Sciences, Ada OH 45810. k-haynes@onu.edu
Previous work has identified an effective antisense oligonucleotide, which effectively blocks monoamine oxidase-B (MAO-B) translation and transcription. The present study was designed to characterize the pharmacodynamic properties of the antisense oligonucleotide. Sprague-Dawley rats were surgically implanted with an intracerebroventricular (ICV) cannula, and the antisense oligonucleotide was administered via the cannula. Histochemical methods were designed to analyze MAO-B enzyme activity and were used to determine antisense effects on translational mechanisms. Reverse transcriptase polymerase chain reaction (RT-PCR) methods were designed to analyze the expression of MAO-B mRNA and were used to determine antisense effects on transcriptional mechanisms. The results suggest enzyme activity decreases at 1, 12, and 24 hours after the seventh dose of antisense, which correlates with the decrease seen in mRNA expression seen 12 hours after the seventh dose. The finding that enzyme activity was reduced within 1 hour of the last dose and mRNA expression did not change until 12 hours after the last dose, suggests that translational mechanisms are blocked before transcriptional mechanisms. The dosing regimen appears to require a minimum of 7 doses to effectively decrease enzyme activity. The method utilized in these studies allowed for in vivo measurements of translational and transcriptional mechanisms within the central nervous system.

2:15 CHROMOSOME 17Q GAIN ASSOCIATED WITH THE PEDIATRIC TUMOR NEUROBLASTOMA. John J. Brown, Stephen J. Qualman, Althea Thomas, Jadwiga Labanowska, and Gail D. Wenger, Childrens Hospital, Cytogenetics Laboratory, 700 Childrens Dr, Columbus OH 43205. Brown.1484@osu.edu
As the most commonly diagnosed extracranial solid malignancy in children, neuroblastoma continues to have a mortality rate of approximately two-thirds despite decades of extensive research. Quantification of the oncogene NMYC, tumor cell ploidy analysis, and chromosome 1p loss of heterozygosity in conjunction with consideration of patient age and clinical stage allow categorization of value to the physician for the purposes of prognosis. It is of importance to identify additional genetic abnormalities that can assist in neuroblastoma therapy development and selection. We have performed fluorescence *in situ* hybridization (FISH) and comparative genomic hybridization (CGH) of neuroblastoma tumors to monitor the unbalanced gain of chromosome segment 17q21.3-q23. FISH of interphase cells was performed using differentially labeled probes toD17S122 (17p11.2-p12) and myeloperoxidase (17q21.3-q23). This method allows the distinction of an unbalanced 17q gain from a balanced change. Eight tumors were studied by FISH; 3/8 showed unbalanced gain of 17q. This change was confirmed by CGH analysis in all 3 tumors. However, in 2/6 tumors studied using both FISH and CGH, concordance between results was not found. Consistently, the unbalanced gain of the chromosome 17q segment has been associated with NMYC amplification. The gain of chromosome segment 17q21.3-q23 is commonly found in patients with advanced poor prognosis neuroblastoma and could become a routine cytogenetic test. Although more labor- and time-intensive, preliminary data suggests CGH may allow more reliable assessment of Chromosome 17 status, as well as providing additional whole genome copy number change information. Additional development and validation of the FISH assay is required for routine clinical use.

2:30 MICROSOMAL EPOXIDE HYDROLASE (*EPHX1*) AND GLUTATHIONE S-TRANSFERASES (*GST*) GENE POLYMORPHISMS IN PATIENTS WITH ORAL-PHARYNGEAL CANCER (OPCA). Armando G. Amador, Paul D. Righi, Shokri Radpour, Eric T. Everett, Edward Weisberger, Mark Langer, Arden G. Christen, Samuel Campbell, Don-Jon Summerlin, James K. Hartsfield Jr., Indiana University, Dept of Medical & Molecular Genetics, 975 W. Walnut, IB-130, Indianapolis IN 46202-5251. aamador@yahoo.com
Xenobiotic metabolizing enzymes have been implicated in the carcinogenesis of tobacco-related neoplasias. Since gene polymorphisms are known to occur in genes coding for

some of these, *GSTM1*, *GSTT1*, *GSTP1* and *EPHX1* in particular, a search for over- or under-representation of any of these genes in patients with OPCA was undertaken. This was done using PCR followed by RFLP for *GSTP1* and *EPHX1*, and by allele specific multiplex PCR for *GSTM1*and *GSTT1*. The study groups included 120 ever-smokers (ES) and 15 never-smokers (NS), which were compared to a random Indiana control population sample of 99 individuals (C). At *EPHX1* codon 113, a significant over-representation of the high activity genotype (TYR/TYR) was observed when compared to C. This was observed for male ES and the overall samples of ES as well as that of NS. A less dramatic but significant over-representation of the TYR/TYR genotype was observed in female NS (P=0.042). The incidence of homozygosity for a null allele at either or both of the *GSTM1* or *GSTT1* loci in OPCA patients indicates that, in ES in general there was an over-representation of the combination of homozygosity for null alleles at both of these loci. This is mainly due to an increased incidence of the *GSTT1* null allele in ES as compared to C (21.45% vs. 10.10; P=0.027). Analysis of polymorphisms at the *GSTP1* locus did not show differences versus C. However, NS had a 3.5 times higher incidence of the low activity producing genotype B/B compared to ES (P=0.043).

2:45 LUPUS: 1) ESTROGEN'S ROLE IN AUTOIMMUNE INDUCTION, AND 2) AN *IN VITRO* GLOMERULAR BINDING ASSAY FOR AUTOANTIBODY PATHOGENICITY. Karl Oliver A. Yu[1], Chuansheng Wang[2], and Betty Diamond[2], Hiram College[1], Depts. of Biology and Chemistry, Hiram OH 44234 and The Albert Einstein College of Medicine[2]. yuka@hiram.edu

Autoimmunity, the condition in which the immune system reacts against self-antigens, underlies diseases such as rheumatoid arthritis, multiple sclerosis and systemic lupus erythematosus. 1) Nephritis (kidney damage) in lupus patients is caused by anti-DNA antibody deposition in renal tissue. R4A, an anti-DNA antibody from BALB/c mice that induces nephritis, and a DWEYSVWLSN decapeptide, that binds to R4A, have been identified previously. DWEYSVWLSN immunization triggers autoimmunity in BALB/c, but not in DBA/2 mice. Previous data suggest that estrogen may play a role in inducing an autoimmune response. To determine if estrogen can break tolerance against autoimmunity, DBA/2 mice with estrogen implants were immunized with peptide. The hyperestrogenic mice did not develop anti-DNA antibodies, disproving the hypothesis. 2) An *in vitro* glomerular binding assay (GBA) was used to measure anti-DNA antibody deposition in glomeruli or tubules removed from renal tissue. This assay represented a possible alternative to a mouse *in vivo* assay, for it had been shown to distinguish between anti-DNA antibodies in those lupus patients with nephritis and in those without. Assay conditions were optimized. The assay was tested on five antibody clones derived from autoimmune mice. Some, though insufficient, correlation was observed between these results and *in vivo* data from the literature; however, the implication was that the GBA cannot substitute for the *in vivo* assay for autoantibody pathogenicity.

3:00 THE Y CHROMOSOME EFFECT OF AGGRESSION ON THE MALE SHR AND WKY. Jonathan D. Toot, Gail E. Dunphy, Daniel L. Ely, University of Akron, Dept of Biology, Akron OH 44325-3908. jtoot@uakron.edu

The hypothesis that was tested is that a locus on the Y chromosome is responsible for increased aggressive behavior in the SHR. Aggressive behavior for male SHR and WKY rats was scored according to physiological and behavioral responses to intermale and resident-intruder tests. The SHR strain was derived from the inbreeding of hypertensive WKY rats. SHR and WKY rats differ genetically only at a locus on the Y chromosome. Housing conditions consisted of 6-8 males with 6-8 females for each strain, which were 10-12 weeks old. This exposed the male rats to social stresses and allowed for the formation of a dominant/subordinant hierarchy. Behavioral tests were run only on male rats for a maximum length of 15 minutes. Female rats had no direct role the behavioral tests. Average systolic blood pressure of WKY was 131mmHg and 166mmHg for SHR significant at $p<0.05$. Baseline plasma measurements indicated a norephinephrine average of 551pg/ml for WKY and 686pg/ml for SHR significant at $p<0.05$. The average epinephrine reading was 204pg/ml for WKY and 343pg/ml for SHR which was not significant at $p=0.069$. Intermale aggression tests showed fighting behavior in 30% of WKY tests and 55% of SHR tests. In conclusion, there is a relationship between norephinephrine, blood pressure, and behavioral characteristics of aggression with a locus on the Y chromosome.

3:30 A STATISTICAL ANALYSIS OF HEARTWORM DISEASE IN NORTHWESTERN OHIO, 1996-98. Aaron M. Sargeant and Eric V. Nelson, 14231 Pasco Montra Rd, Anna OH 45302. a-sargeant@onu.edu

Heartworm positive cases from a predominantly small-animal veterinary clinic located in northwestern Ohio were analyzed to determine common factors among infected dogs. To indicate seasonal patterns associated with the disease and the impact of the recent switch to year-round prophylaxis, the monthly distributions of positive tests and total dogs tested were ascertained for a three year time span, 1996-98. From the positive cases diagnosed in 1998, physical characteristics of the dogs, including breed, color, age, weight, and gender, were tabulated to indicate preferences of the mosquito vector and potential high-risk animals. It was suspected that most effected dogs were large breeds of old age. The geographical distribution by zip code of 1998 dogs was also determined to designate endemic areas. Results showed that heartworm infections doubled from 1996-97 to 1998. A positive correlation of heartworm was found in dogs of large size, dark hair color, and 1-3 years of age. No positive tests were obtained from white dogs. The difference between sexes was slight. The prevalence of heartworm has increased in recent years and large, middle-aged dogs with dark hair coats may be at higher risk.

3:45 L-ARGININE PRECONDITIONING IMPROVES RECOVERY OF THE HEART AFTER ISCHEMIA IN SPONTANEOUSLY HYPERTENSIVE (SHR) RATS. Seth Bradford, Michael Herman, Gail Dunphy and Daniel Ely, University of Akron, Dept of Biology, Akron OH 44325-3908.

This study was designed to determine whether preconditioning through administration of L-arginine in drinking water could help prevent damage which occurs during ischemia in spontaneously hypertensive male rat hearts. Previous studies of this experimental method have shown that there is a significant decrease in coronary flow following ischemia, and L-arginine is a precursor of the well-known vasodilator nitric oxide. One group was given L-arginine (1.2 g/L) in drinking water (n= 6) for three to four weeks, while the control group (n= 5) was kept on its normal water. The hearts were then perfused using the Langendorff technique both before and after a twenty-minute ischemia. During this ischemia, the flow of the perfusate was turned off so that it does not receive any oxygen or nutrients. The hearts of the rats given L-arginine had significantly higher ($P<0.05$) ventricular systolic pressures than the control group, as well as significantly higher ($P<0.01$) coronary flows after the ischemia. The administration of L-arginine appears to improve the recovery of the heart after ischemia, most likely due to the vasodilatory actions of nitric oxide.

4:00 MAMMOGRAPHY TOMOSYNTHESIS USING A COUPLED SOURCE AND DETECTOR IN A C-ARM CONFIGURATION. Joseph T. Rakowski, Michael J. Dennis, Medical College of Ohio, Dept of Radiology, Toledo OH 43614. joe_rakowski@mhsnr.org

Mammography is, by far, the best diagnostic tool for detecting early stage breast cancer. However, despite the technological and quality improvements in recent years, 10% - 30% of breast cancers may not be detected, while other cancers are not detected early enough to allow effective treatment. The primary reason for missed diagnosis is that the cancer is often obscured by fibroglandular breast tissue that is radiographically dense. A tool that could potentially prove valuable at improving the detection of early breast cancer, especially in radiographically dense breasts, is tomosynthesis. Tomosynthesis is the process of reconstructing planes of interest at any level in an object from limited angle projection data in a manner similar to conventional focal plane tomography. Niklason, et.al., using a full field digital mammography system with a stationary detector geometry, demonstrated that tomosynthesis can improve lesion margin visibility especially in radiographically dense breasts. Instrumentarium Corporation has adapted a tomography technique, developed by Webber and Horton at Wake Forest University, to a small field mammographic spot imaging and stereotactic biopsy system with a stationary detector, and is seeking FDA approval. We have implemented a digital tomosynthesis method for use with isocentric stereotactic breast biopsy units having digital imaging capabilities. Our method reconstructs planes of user-selected orientation and distance from the isocenter. The images were collected on a Lorad stereotactic prone breast biopsy unit with a 1024 x 1024 digital image receptor. The X-ray source and image receptor were coupled in a C-arm configuration, both rotating about a central axis. Image quality was enhanced by processing the images to remove overlying and underlying structures outside the plane of interest. Image quality was evaluated in terms of the line spread function, low contrast detectability, and ACR stereotactic accreditation phantom target visibility, including the dependence of image quality on exposure per projection and number of projections. High contrast spatial resolution was reduced slightly with tomosynthesis to 0.32 mm Full Width Half Maximum (FWHM), or 6.5 line pairs/mm versus 0.18 mm FWHM, or 7.5 line pairs/mm for a single projection image. The most striking result of the tomosynthesis application was the improved visibility of the low contrast test object obscured by overlying and underlying structures. Although the percent image contrast was greater with a single projection without tomosynthesis, the tomosynthesis reduced the Region of Interest (ROI) pixel value standard deviation to approximately 1/6 that of the single projection image. The pixel value coefficient of variation was also reduced to approximately ¼ that of the single projection image. This demonstrates the ability of tomosynthesis to substantially reduce structured noise. Visibility of the ACR phantom was reduced slightly with tomosynthesis, with visible speck groups reduced to 3 from 3 ½, visible fibers reduced to 3 from 4, and visible masses unchanged at 4. The data from unobscured low contrast test phantom images showed a predictable outcome with respect to mAs and number of projections. Increasing the mAs per projection reduced the image noise and increased image contrast, while reducing the number of projections from 9 to 5 increased the image noise, but had an indeterminate effect on image contrast. Tomosynthesis has the potential to be an extremely useful diagnostic tool, not only for early detection of breast cancer, but also for enhancing digital subtraction angiography images, which are acquired using a similar isocentric C-arm source/detector configuration.

4:15 TOBACCO CONSUMPTION RATES AND PATTERNS IN RECENT ATHLETE (FOOTBALL)AND NON-ATHLETE MID-AMERICAN CONFERENCE GRADUATES. Jack R. Thomas[1], Mary C. Mitchell[2], Alma M. Saddam[2], [1]Mount Carmel College of Nursing, Columbus OH 43222. [2]Ohio State University, Dept. of Human Nutrition. thomas.72@osu.edu

This multivariate study examined tobacco consumption among recent college graduates. A questionnaire was mailed to randomly selected male graduates from eight Mid-American Conference universities who completed their degrees between the years 1990 and 1994 Participants included 219 former football players (75.3% return rate) and 173 non-athlete graduates (65.3% return rate). According to a report from National Center for Health Statistics, in 1995, 24.5% of the male United States population aged 18 and over smoked cigarettes. This study found 32 % of all respondents considered themselves to be at least occasional users of tobacco products with no significant difference between former football

players and non-athlete graduates (p= 0.854). Cigarette smoking and smokeless tobacco rates were 7.5% and 17.8% for the former football players, and 16.3% / 8.7% respectively for the non-athlete graduates (p= 0.0007, p=0.010). Cigar smoking, at least occasional, rates were similar for former football players at 13.6%, and 14.5% for non-athlete graduates (p=0.796). For the examined five years after graduation, no significant change in tobacco consumption was observed in either group. Graduation is a time of transition for college males. Their lifestyles are forced to adapt to a change in environment. This is especially true for former athletes whose time was divided between academics and athletics. This study reports similar athlete/non-athlete overall tobacco consumption rates slightly higher than national averages. For the populations in question, this study provides base-line data on cigar smoking rates. The former football players smoked less but chewed more than non-athlete graduates. In both groups, the number of tobacco users did not change for any of the studied five years after graduation.

4:30 THE EFFECTS OF ERYTHROPOIETIN (EPO) ON RETICULOCYTE COUNTS IN DIALYSIS PATIENTS RELATIVE TO PATIENT AGE, GENDER, RACE, EPO DOSAGE, AND DURATION OF RENAL DISEASE. Jennifer L. Johnson (Linda M. Young), Ohio Northern University, Dept. of Biological Sciences, Room 163 Meyer Hall, Ada OH 45810. j-johnson1@onu.edu

Patients with chronic renal dysfunction generally have reduced red blood cell (RBC) counts caused by the combined effects of erythropoietin deficiency and mechanical damage during dialysis. Consequently, the focus of this study is to determine the possible effects of recombinant human erythropoietin (rHuEPO) on anemia caused by renal dysfunction. This analysis is limited to a correlative study between patient reticulocyte counts and the following parameters: patient age, gender, race, rHuEPO dosage, and duration of renal disease. Monthly blood samples were collected from 45 dialysis patients and 5 healthy controls at Lima Memorial Hospital Renal Clinic. Manual reticulocyte counts were performed on all samples and the data correlated with the indicated parameters. Additionally, these samples were run on the Abbott Cell Dyne 3500 to verify agreement of automated versus manual reticulocyte counting as part of the laboratory's quality control program. Preliminary results indicate recombinant human erythropoietin is effective in the treatment of anemia caused by renal dysfunction.

Plant Ecology
09:00AM Saturday, April 1, 2000
Meyer Hall Room 125
Brian C. McCarthy - Presiding

9:00 IMAGE ANALYSIS AS A TOOL FOR PLANT POPULATION STUDIES. Sarah M. Emery, Juliana C. Mulroy, and Jennifer A. Rudgers, Denison University, Slayter Box 662, Granville OH 43023. emery_s@dension.edu

Image analysis is a tool for gathering information from visual images such as photographs. It has widespread application, but there has been relatively little published use of image analysis as a tool in plant ecology. We used NIH Image, a public domain image analysis program available from the National Institutes of Health, to study intraspecific competition in the small, rosette-forming winter annual, *Draba verna* (Brassicaceae). We present our findings on the use of image analysis in this context. From macro photographs taken above 80 2x10cm study plots, we were able to create time series "movies" of the entire life cycle of individuals in quadrats with a range of naturally-occurring densities. We quantified the growth of individual plants, using NIH Image to measure changes in leaf area and rosette diameter over time. Data were gathered without disturbing the plants and analyzed through the use of semi-automated measurements. Distinguishing individuals at high population densities and in areas with debris was sometimes difficult; studying species with three-dimensional growth forms would present additional challenges. Benefits of using image analysis include the ability to (1) characterize "neighborhoods" of plants based on rosette size and proximity of nearby individuals instead of using the mean measure of density for competition studies, (2) see various stages of the life cycle in one analysis session, (3) capture large amounts of data with limited field time, and (4) have permanent visual records of all growth stages, allowing new hypotheses to be generated or tested without additional field seasons.

9:15 VEGETATION ECOLOGY AND NATURAL HISTORY OF DEEP WOODS, HOCKING COUNTY, OHIO. Cynthia L. Riccardi and Brian C. McCarthy. Ohio University, Dept of Environmental and Plant Biology, Athens OH 45701-2979. Criccardi@rocketmail.com

Deep Woods, a 114-ha private preserve in Hocking County, Ohio, offers a diversity of habitats and species. Second-growth lowland and upland hardwood forest, riparian forest, hemlock ravines, sandstone outcrops, rockhouse formations and pastures provide areas worth conserving. The bedrock geology consists of sedimentary rock from Mississippian and Pennsylvanian formations with alluvium deposits along the riparian corridor. Three soil orders are represented: alfisols, inceptisols, and ultisols. The forests have been subjected to long-term anthropogenic disturbance. Historically, the first inhabitants of the area were ancient moundbuilders (ca. 2500 YBP). During the 1700s, Shawnee and Delaware groups resided throughout the county. All Native American groups were driven out of the area by the early 1800s. The original land survey data collected in 1801 by J. Spencer suggested that the dominant vegetation was composed of *Quercus alba, Q. velutina,* and *Carya* spp. (relative importance value, RIV = 34.2, 13.3, 12.0%, respectively). Tax records show that Anglo-ownership of the property dates from mid-1830s. County death records show occupations of 19th century owners as predominantly farmers. Presently, three major forest vegetation types have been identified: hydric floodplain, mesic upland and xeric ridgetop. *Betula nigra, Carpinus caroliniana* and *Ulmus rubra* (RIV = 16.0, 11.0, 11.0%) dominate the floodplain. *Liriodendron tulipifera, Acer saccharum* and *B. alleghaniensis* (RIV = 22.0, 15.0, 11.0%) and *A. rubrum, Q. prinus* and *Q. alba* (RIV= 27.0, 13.0, 9.0%) dominate the upland and ridgetop, respectively. The historical vegetation suggests a different species assemblage than found in the present forest.

9:30 REVEGETATION AND RESTORATION OF A LOWLAND FOREST COMMUNITY IN HAMILTON COUNTY, OHIO. Carolyn H. Keiffer[1] and Brian C. McCarthy[2], [1]Miami University, Dept. of Botany, Middletown OH 45042. [2]Ohio University, Dept. of Environmental and Plant Biology. keiffech@muohio.edu

Restoration ecology employs conservation principles to replace biological populations or habitats that have been anthropogenically disturbed. However, many subtleties of the restoration process, particularly in complex systems such as forests, are not well understood. We evaluated different planting regimes in restoring a lowland forest that had been converted to pasture on an industrial site in southwestern Ohio. Species used in this experiment included: *Aesculus octandra, Fraxinus pennsylvanica, Celtis occidentalis, Juglans nigra,* and *Quercus muhlenbergiii.* Eight 0.1 ha plots were established such that there were two each of four treatments: Control (no additions), Seedlings (120 individuals of 5 species added), Saplings (20 individuals of 5 species added), Mixed (120 seedlings, 10 saplings, each of 5 species). One-third of the seedlings in each plot received a deer browsing tube. We evaluated growth and survival after one growing season. Saplings had greater overall survival (> 80%) than did seedlings (< 35%). All sapling species performed well with the exception of *Celtis,* which had ca. 50% mortality of saplings, 62% mortality of tubed seedlings, and 95% mortality of unprotected seedlings. Most of this mortality was attributable to drought. *Quercus* saplings were the most heavily affected by deer browsing. Vole damage (bark stripping) was apparent on 5% of *Fraxinus* and *Aesculus* saplings. Survival of *Celtis* and *Fraxinus* seedlings was greater with tubes. However, survival of *Juglans* and *Aesculus* was greater without a browsing tube (82 and 92% respectively). While no treatment effects were obvious after one year, species and size class responses were demonstrative.

9:45 VASCULAR FLORA OF AN ECOLOGICALLY DISTURBED INDUSTRIAL SITE IN BUTLER COUNTY, OHIO. Brian C. McCarthy and Darrin L. Rubino. Ohio University, Dept of Environmental and Plant Biology, Athens OH 45701. mccarthy@ohio.edu

Governmental and environmental agencies are increasingly interested in biodiversity data for the purposes of preservation and restoration. This interest has created important new constituencies for the products of floristic research. As an initial step in identifying local taxa for subsequent preservation and restoration efforts, we conducted a floristic inventory of the vascular plant species of the Fernald Environmental Management Project, a 425 ha facility located 30 km northwest of Cincinnati, Ohio. Between 1953 and 1989, the U.S. Department of Energy facility, then called the "Feed Materials Production Center," produced uranium metal products. In 1989, uranium metal production was suspended and resources shifted to environmental restoration. We studied a defined 50 ha site composed of five apparent habitats: old-fields, moist meadows, young forest, old forest, and "disturbed". While the specific study site was not directly impacted by industrial activities, the area has been regularly grazed by cattle, annually mowed, and otherwise perturbated by motor vehicles. We examined the vascular flora across two full growing seasons (1998-99) with tri-weekly visits (12 collection trips). We discovered a total of 332 taxa in 200 genera and 75 families. Asteraceae (42 taxa) and Poaceae (41) were the most important families; *Carex* (15) and *Quercus* (8) were the most important genera. No taxa were state listed as threatened or endangered. As is typical of many disturbed sites, a relatively large proportion (31%) of the taxa were non-native to the region. *Lonicera maackii* and *Alliaria petiolata* are invasive and appear to be negatively impacting native species.

10:00 THE EFFECTS OF MECHANICAL, BIOLOGICAL AND CHEMICAL TREATMENT METHODS ON AN INVASIVE PLANT, THE GIANT REED (*PHRAGMITES AUSTRALIS*). Curt S. Schaeffer and Dr. David A. Francko, Miami University, Dept. of Botany Oxford OH 45056. mrmustard73@hotmail.com

The native flora of Mentor Marsh, a Lake Erie coastal wetland near Cleveland, OH, is being replaced by an exotic invasive species, *Phragmites australis.* In 1998, we conducted a pilot study that showed that controlling and limiting the spread of this species was possible and seedbank species could re-establish. A 1999 large-scale study was designed to observe the response of *P. australis* to several treatments. Treatment methods were applied as follows: cutting and removal of emerging shoots of *P. australis,* treatment one coupled with application of herbicide and either covering with shade cloth or planting *Typha lattifolia,* and continuous cut and removal of stems. Control plots were left untreated. Stem counts were taken every three or four weeks along with species occurrence, conductivity and water temperature and depth on sixty 9m2 cells. After 15 weeks, control plots and single-cut plots exhibited a mean stem count of 81 +/- 10 /m2 and 90 +/- 17 /m2 respectively. The multiple cut plots had a mean stem count of 4 +/- 2 /m2 and a p-value of > 0.0001. Both single cut and control plots exhibited increasing stem densities up to the end of the growing season,

while the multiple cut plot stem densities began to decrease earlier in the growing season. Continuous cut and removal of reed shoots is the most effective method of treatment examined in this study.

10:15 FOREST RESTORATION FOLLOWING THE REMOVAL OF AN INVASIVE SHRUB, AMUR HONEYSUCKLE (*LONICERA MAACKII*). Kurt M. Hartman and Brian C. McCarthy, Ohio University, Dept of Environmental and Plant Biology, Athens OH 45701. kh349592@ohiou.edu

Amur honeysuckle (*Lonicera maackii*) is a non-native, invasive shrub that is now common throughout southwestern Ohio. Various studies have shown *Lonicera* to have a negative impact on native plant diversity and abundance. The purpose of this study was to evaluate two methods for the eradication of *Lonicera* and to assess the performance of planted seedlings following removal. We employed a randomized complete block design (N = 8) with three treatment plots per block: control (unmanipulated), cut (*Lonicera* cut, stumps herbicided), and injection (*Lonicera* stems injected with herbicide). In each treatment plot, 10 seedlings of 6 species were planted: *Juglans nigra*, *Fraxinus pennsylvanica*, *Quercus muhlenbergii*, *Prunus serotina*, *Cornus florida*, and *Cercis canadensis*. Browse tubes were added to half of the seedlings to evaluate browsing pressure. *Lonicera* kill rates were similar for both treatment methods, thus injection may be preferred due to its ease of application. Experiment-wide, seedling survival was low (49%) due to severe drought (PDSI < -3). There was differential seedling survival among blocks, treatments, species, and tubes. Seedling survival and growth varied among blocks due to environmental heterogeneity. Seedling survival was greatest in the removal treatments compared to the controls. Overall, survival actually decreased with browse tubes (44% vs. 56%), but mean height growth was greater with a tube vs. without. The presence of a species ? tube interaction indicates that survival was species dependent. Browse frequency was related to species but not to block or treatment. The data suggest that there were multiple factors leading to the survival and growth of seedlings.

Animal Ecology and Behavior
02:00PM Saturday, April 1, 2000
Meyer Hall Room 125
Danny J. Ingold - Presiding

2:00 RELATIONSHIPS BETWEEN SEED FALL OF THREE TREE SPECIES AND PEROMYSCUS LEUCOPUS AND CLETHRIONOMYS GAPPERI DURING 10 YEARS IN AN OAK-PINE FOREST. Karen E. McCracken[1], Jack W. Witham, and Malcolm L. Hunter Jr., University of Maine, [1]Defiance College, Dept. of Natural Sciences, Defiance OH 43512. kmccracken@tdc.edu

We analyzed live-trapping data from 10 years (1983-1992) of a long-term study of forest ecosystems in southern Maine to investigate relationships between seed fall of red oak (*Quercus rubra*), white pine (*Pinus strobus*), and red maple (*Acer rubrum*), and populations of *Peromyscus leucopus* and *Clethrionomys gapperi*. Spring populations of *Peromyscus* were correlated positively with crops of both red oak and white pine in the previous autumn; summer populations were correlated only with the acorn crop of red oak in the previous year. Populations of *Clethrionomys* were not correlated with either red oak or white pine in spring or summer. The increase from spring to summer in *Peromyscus* was associated positively with the magnitude of seed fall from red maple in the current year. Following years of above average acorn production of red oak, adult male and female *Peromyscus* weighed more than in years following low acorn production. Following 2 years of high acorn production, captures of *Peromyscus* were associated positively with the number of live red oak > 10 cm diameter at breast height per 0.25-ha quadrat. Group-selection logging was associated with increased summer captures of *Peromyscus* per quadrat for 2 of 4 years, probably due to an increase in both herbaceous cover and fruit production of shrubs.

2:15 THE HIBERNATING BATS OF ZANE-SHAWNEE CAVERN, LOGAN COUNTY, OHIO. Jennifer L. Cudney (Carl W. Hoagstrom), Ohio Northern University, Dept. of Biological Sciences, Ada OH 45810. j-cudney@onu.edu

Zane-Shawnee Cavern is a commercial cavern in Logan County, Ohio. Despite the commercial use of the cavern throughout the winter, a number of bats use it as a hibernaculum. The bats are being censused periodically to determine the importance of the cavern as a hibernaculum. At each census, bats are counted by a group of at least three persons searching the main cavern. Each bat's location in the cavern, position (on the wall or ceiling), placement (in crevices or exposed) and height from the floor of the cavern are recorded. Observation from one year (the winter of 1996-1997) and quantitative data, collected as described above, from two years (winters of 1997-1998 and 1998-1999) resulted in some preliminary conclusions: (1) Bat counts have been quite reproducible among censuses. (2) Hibernating bat populations of eastern pipistrelles (*Pipistrellus subflavus*) and big brown bats (*Eptesicus fuscus*) have been constant from year to year (about 50 and 20 respectively). (3) Little brown bats (*Myotis lucifugus*) use the cavern more sporadically, either hibernating there some years, and not others, or using the cavern as a transient roost in travel between their hibernaculum and summer range. At least one northern long-eared bat (*Myotis septentrionalis*) roosted in the cave for at least two weeks in the spring of 1999, probably in transit from its hibernaculum to its summer range. Zane-Shawnee Cavern is used by at least four species of bats and should be considered a valuable asset to the bat community of Logan County.

2:30 ARE ENVIRONMENTAL FACTORS RESPONSIBLE FOR THE DECLINE IN *CHELONIA MYDAS AGASSIZZI* (BLACK TURTLE) POPULATIONS OF BAHIA MAGDALENA, MEXICO? Jennifer L. Cudney and Regina Woodrom Luna (Luis E. Calderon), Ohio Northern University, Dept. of Biological Sciences, Ada OH 45810. j-cudney@onu.edu

Bahia Magdalena is a vital habitat in the life cycle of black turtles, which migrate to the area after hatching to grow and develop through intensive feeding on red algae, sea grass and eventually invertebrates and fish. After an unknown period of time (8 to 20 years), turtles migrate back to their nesting beaches to reproduce. The feeding grounds support an estimated but declining population of 3000 to 5000 turtles. These turtles are an important component of the Bahia Magdalena ecosystem, and were an economic asset to the people of coastal towns as they were hunted to fulfill an international demand for turtle products. Loopholes in current laws permit fishermen to keep turtles that are incidental bycatch. To assess the effect of environmental factors on the black turtle population, we evaluated the water quality (pH, salinity, dissolved oxygen, turbidity) and the primary production (light and dark bottles method) in different locations in Bahia Magdalena. We estimated the sea grass and algae abundance (using quadrants), we collected benthic invertebrates (core sampling), and conducted observation and gut content analysis of turtles and other predominant species. The estimated biomass of black turtles, seagrass, and invertebrates in Magdalena Bay were 0.5 t/km^2, 1.887t/km^2, and 102.9t/ km^2, respectively. The data compared with past studies on physiological and nutritional needs of turtles indicate that Bahia Magdalena is a suitable habitat for the black turtle. It is presumed that illegal catching and other anthropogenic factors are responsible for the decline of the black sea turtle population.

2:45 ACID RAIN, EGGSHELL-THINNING, AND THE EXTINCTION OF THE PASSENGER PIGEON. Jack Kovach, Muskingum College, Geology Dept., New Concord OH 43762. jkovach@muskingum.edu

The suggestion that acid rain from industrial pollution is the most likely cause of the progressive thinning of the shells of eggs of British thrushes (*Turdus* spp.) over the past 150 years causes one to wonder if this phenomenon may have played a role in the extinction of the passenger pigeon (*Ectopistes migratorius*) in North America. With a population estimated at 2 to 5 billion (Schorger, 1955, *The Passenger Pigeon*: Univ. of Wisc. Press, Madison), concentrated in huge flocks, the calcium requirements for eggshell development in passenger pigeons, although apparently only one egg was laid by the nesting female (ibid., p. 109), would have been sizable. Hence any reduction of the calcium content of mast (the preferred diet of passenger pigeons (ibid., p. 35)) and of leaf litter consumed by earthworms ("...sought and eaten with avidity..." by passenger pigeons (ibid., p. 47) or reduction in abundance of land snails ("...sought eagerly by the pigeons," (ibid., p. 49), all of which are documented effects of acid rain, may have resulted in eggshell-thinning and a reduced reproductive success that may have contributed to the bird's decline and eventual disappearance. Evidence from paleolimnological studies and other sources indicates that industrial pollution in eastern North America was rapidly increasing during the time frame in which the passenger pigeon declined to extinction.

3:00 HABITAT USE AND REPRODUCTIVE SUCCESS OF GRASSLAND NESTING BIRDS ON A RECLAIMED STRIP-MINE. Danny J. Ingold, Muskingum College, Biology Dept., New Concord OH 43762. Ingold@muskingum.edu.

Although reclaimed strip-mines are artificial ecosystems, they provide a refuge for a variety of grassland birds, whose populations are declining and that might not otherwise survive in the area (e.g., Henslow's sparrows, *Ammodramus henslowii*; grasshopper sparrows, *A. savannarum*; short-eared owls, *Asio flammeus*). During the 1997 and 1998 breeding seasons habitat selection and the nesting success of grassland birds were studied on a 3,700 ha reclaimed stripmine (the Wilds) in Guernsey, Muskingum, and Noble counties in east-central Ohio. Grasshopper sparrows, eastern meadowlarks (*Sturnella magna*), red-winged blackbirds (*Agelaius phoeniceus*) and Henslow's sparrows were the most abundant nesting species on the reclaimed mine. Short-eared owls and Henslow's sparrows avoided nesting on plots that were mowed just prior to the onset of nesting. There were significantly more nests ($P < 0.05$) of all species located on unmowed versus mowed plots during both years, and pairs using mowed plots tended to initiate nesting later in the season. Red-winged blackbirds were the most abundant and most successful nesting species on the surrounding control plots. A Mayfield analysis indicated that grasshopper sparrows had the greatest nesting success on the experimental plots, followed by red-winged blackbirds and eastern meadowlarks. Nests on mowed plots suffered higher predation rates (47%) than did nests on unmowed (39%) and control (38%) plots. These data suggest that Henslow's sparrows, short-eared owls, grasshopper sparrows and other uncommon grassland breeders in Ohio, are benefitting from this expansive, reclaimed surface mine.

3:15 SMALL MAMMALS OF THE WABASH MORAINE, HARDIN COUNTY, OHIO. Carl W. Hoagstrom, Ohio Northern University, Dept of Biological Sciences, Ada OH 45810. c-hoagstrom@onu.edu

The Wabash Moraine was deposited by the retreating Wisconsin glacier. It dammed the northerly flow of the Scioto River, eventually turned the river south and simultaneously created the Scioto Marsh in Hardin County, Ohio. Two live-trap grids set on the moraine have been monitored since 1977, to follow changes in the small mammal communities. One grid of 100 traps was in a woods and the other, with 78 traps, was in an abandoned farm

field. Each grid was trapped six times at approximately eight hour intervals over a two day period each April and October. Captured animals were identified to species, marked with a unique toe clip number, sexed, aged, checked for parasites and injury, weighed and released. Population sizes were estimated using the Schnabel equation for repeated mark recapture data. White-footed mice (*Peromyscus leucopus*) and northern short-tailed shrews (*Blarina brevicauda*) were captured regularly on both grids. Meadow voles (*Microtus pennsylvanicus*) were captured regularly on the field grid but only occasionally on the woods grid. Other species captured were—masked shrews (*Sorex cinereus*), meadow jumping mice (*Zapus hudsonius*), deer mice (*Peromyscus maniculatus*), house mice (*Mus musculus*), Norway rats (*Rattus norvegicus*), red squirrels (*Tamiasciurus hudsonicus*), southern flying squirrels (*Glaucomys volans*), eastern chipmunks (*Tamias striatus*), and least weasels (*Mustela nivalis*). Population fluctuations were not correlated among species, implying species specific regulatory factors. The small mammal community of the field changed more than that of the woods, probably because of greater changes in the vegetation due to ecological succession.

3:30 ANALYSES OF FLORIDIAN HISTORICAL BIOGEOGRAPHY AND LATE CENOZOIC PALEOGEOGRAPHY USING WOLF SPIDERS (LYCOSIDAE: *GEOLYCOSA*) AS A MODEL TAXON. Kory A. Thornburg (Walter R. Hoeh, Sammuel D. Marshall), Kent State University, Dept. of Biological Sciences, Kent OH 44242. kthornbu@kent.edu

The endangered Floridian scrub habitat is limited to insular upland sand ridges and dune systems which are typified by low, sparse vegetation and patches of dry, sterile sand. This habitat is being rapidly destroyed by fire suppression, which leads to succession of naturally open habitats to closed xeric oak hammocks; and development for citrus cultivation and housing. Optimal choices of where to concentrate conservation efforts depend on recognizing areas of greatest biotic significance. Furthermore, in addition to knowing little about this habitat's biogeographic history, not much is known about the flora and fauna that are closely associated with the endangered Floridian scrub. *Geolycosa* wolf spiders, with their limited dispersal and narrow habitat requirements, are an ideal model taxon for studying the biotic diversity patterns and biogeographic history of Floridian scrub. Currently, 15 species of *Geolycosa* have been described based on a limited number of morphological characteristics. As a result, the species limits and evolutionary relationships are poorly understood. The goals of this project are to (1) estimate the evolutionary relationships among *Geolycosa* species using comparisons of cytochrome *c* oxidase subunit I (CO1) DNA sequences and (2) use these relationships to infer the historical pattern of Floridian scrub habitat evolution. *Geolycosa* individuals from a total of 33 Florida scrub sites were collected and identified based on morphological characteristics. DNAs from 74 individuals representing the species *G. escambiensis, G. micanopy, G. patellonigra, G. x. xera, G. x. archboldi, G. hubbelli, G. ornatipes, and G. pikei* were extracted and a portion (ca. 710 base pairs) of the COI gene amplified using the polymerase chain reaction. To date, the DNA fragments from 14 individuals representing 14 different collection sites have been cycle sequenced.

3:45 THE EFFECTS OF *HETERODERA GLYCINES* ON OVERALL HEALTH AND YIELD IN *GLYCINE MAX*. Benjamin R. Smith and Linda M. Young, Ohio Northern University, Dept. of Biological Sciences, Room 163 Meyer Hall, Ada OH 45810. b-smith2@onu.edu

Since yield is a top priority of soybean farmers in Ohio, we attempted to assess the impact of *Heterodera glycines* (Soybean Cyst Nematode-SCN) infestation on yield. Additionally, the effect of *Rhizobium* soil enhancement was monitored to determine whether it could alleviate any negative effects of SCN infestation. This was accomplished by observing the overall health and yield of soybeans (*Glycine max* Dekalb 278) under the following conditions: Control plants growing in sterilized, standard greenhouse soil; *Rhizobium*-inoculated, standard greenhouse soil; SCN-infested soil mixed 1:1 with greenhouse soil; and SCN-infested soil mixed 1:1 with greenhouse soil and inoculated with *Rhizobium*. Overall health was monitored with weekly height measurements, and monthly determinations of leaf chlorophyll concentration, leaf protein content, and root nodule number and mass. Yield assessment included pod number/plant, seed number/pod, seed mass/plant, and mean seed mass/treatment. SCN-infested plants showed significant reduction of root nodulation compared with control and *Rhizobium*-inoculated plants. However, *Rhizobium* enhancement of SCN-infested plants restored nodulation to control levels. This finding correlates with decreases in pods/plant and seed mass/plant in the SCN-infested groups. There appears to be a partial recovery of seed mass/plant with *Rhizobium* enhancement. These preliminary data suggest that SCN infestation does negatively impact specific health and yield parameters of soybeans and that *Rhizobium* enhancement of the soil may counteract these effects to varying degrees.

4:00 REMARKABLY FEMALE-BIASED SEX RATIOS IN SOME COLLECTIONS OF BROOD V (1999) PERIODICAL CICADAS, EASTERN OHIO. Jack Kovach, Muskingum College, Geology Dept., New Concord OH 43762. jkovach@muskingum.edu

The sex ratio of periodical cicadas (*Magicicada* spp.) at emergence is 1:1 (Karban, 1983). That same author reported that bird predators (at least house sparrows (*Passer domesticus*), described by some as the greatest enemies of periodical cicadas) select females in preference to males. In mid-June 1999, following the main emergence of periodical cicada Brood V over much of eastern Ohio, the author, while touring American Electric Power Company's Muskingum River and Conesville power plants (located, respectively, at Waterford (Washington Co.) and Conesville (Coshocton Co.)), had opportunity to obtain grab samples of dead cicadas on the floors of the unenclosed decks of these multistory facilities at considerable heights above the canopy of nearby forested areas. A sample of 14 specimens was collected in no systematic manner on June 16 from among the thousands of dead cicadas littering the floor of the deck at 43 m above the ground surface at the Unit #5 facility of the Muskingum River Plant. This sample was found later to consist entirely of females. 43 of 46 total specimens collected on June 18 some 67 m above ground level on the 14th floor of the Conesville Plant were female. These highly-skewed sex ratios are remarkable and may indicate that female periodical cicadas, despite their larger size (or perhaps because of it), are stronger fliers than males, in keeping with their tendency to disperse from chorusing centers after mating.

4:15 SOME ESTIMATES OF NYMPHAL POPULATIONS OF 17-YEAR CICADAS (BROOD V) IN EASTERN OHIO, 1999. Jack Kovach, Muskingum College, Geology Dept., NewConcord OH 43762. jkovach@muskingum.edu

Counts of nymphal emergence holes of Brood V periodical cicadas (*Magicicada* spp.) were made in June at sites in Muskingum County. Two to fifteen 1-ft.2 (0.093 m2) plots were selected at each site by tossing a cardboard frame onto the ground surface beneath the foliar canopy of one or more trees at the site. Litter was removed from the plots, and emergence holes (which, due to compaction of their walls, remain intact long after the nymph has left its burrow, and which are so distinctive that they are unlikely to be confused with holes made by other organisms) were counted. Any such hole partly or entirely inside the perimeter of the quadrat was counted. Quadrats with more than 10-12 holes were censused by inserting a plastic drinking straw in each hole, then retrieving and counting the straws. Mean numbers of emergence holes/ft.2 varied from 4.6 (range 2 - 8, N = 3) beneath a slippery elm (*Ulmus rubra*) at the Education Center at the Wilds (Meigs Twp.) to 22.7 (range 2 - 36, N = 15) beneath a sugar maple (*Acer saccharum*) on the campus of Muskingum College in New Concord (Union Twp.). Mean numbers of emergence holes/ft.2 beneath a white pine (*Pinus strobus*) at Muskingum Area Technical College Natural Resources Center (Falls Twp.) and a beech tree (*Fagus grandifolia*) 0.75 mi. NNE of Rix Mills (Union Twp.) were, respectively, 21.3 (range 15 - 32, N = 3) and 13.1 (range 3 - 21, N = 10). These figures fall within the ranges reported by earlier workers using more elaborate census techniques to investigate previous emergences of periodical cicadas in Ohio and elsewhere in the midwestern U.S.

4:30 ASPECTS OF DOWNY WOODPECKER PREDATION ON GOLDENROD GALLS. Kathryn L. Wilson (Carl W. Hoagstrom), Ohio Northern University, Dept. of Biological Sciences, Ada OH 45810. k-wilson@onu.edu

Eurosta solidaginis lays its eggs in the stems of goldenrods (*Solidago* spp.). Downy woodpeckers (*Picoides pubescens*) prey upon these galls, extracting the larva after drilling a characteristic hole in the gall. Three factors which might influence woodpecker predation on the galls are under investigation: (1) proximity to tree stands, (2) size of the tree stand, and (3) density of the galls. The impacts of these factor are being tested in two fields in Hardin County, Ohio—one surrounded by a closed canopy, subclimax woods; the other including scattered, small stands of trees. A general linear analysis of variance will be employed to sort out the impact of the factors and their interactions on woodpecker predation on goldenrod galls. Sixty regularly spaced, circular (0.7 meter diameter) quadrats will be sampled in each field, thirty adjacent to woods or to small stands of trees, and thirty as far away from the woods or tree stands as field size and goldenrod distribution permit. The quadrats in each group of thirty will be subdivided into those with a high density and those with a low density of galls. The number of goldenrod plants, the number with *Eurosta* galls and the number of galls with downy woodpecker holes will be counted in each quadrat. Preliminary results suggest that downy woodpecker predation on goldenrod galls (1) does not differ between the two fields, (2) is more intense near woods or tree lines and (3) is more intense in patches with high densities of goldenrod galls.

Molecular Biology I

09:00AM Saturday, April 1, 2000

Meyer Hall Room 126

Amy Lynn Aulthouse - Presiding

9:00 THE ROLE OF FOCAL ADHESION KINASE IN NEURONAL CELL ADHESION. Alison McCormack (Dr. Catherine N. Smith), Denison University, Slayter Box 1378, Granville OH 43023. mccorm_a@denison.edu

Adhesion in normal cells is necessary for cell survival in that cells die due to lack of adhesion. This process, called anoikis, has been studied in depth in fibroblasts, but not neuronal cells. When fibroblast cells undergo anoikis, intracellular signaling molecules are affected. The tyrosine kinase focal adhesion kinase (FAK) has been shown to be involved in cell adhesion in fibroblasts. When activated, FAK has been demonstrated to promote cell migration on extracellular matrix proteins. When constitutively active, FAK also contributes to survival of epithelial cells in suspension. The hypothesis being tested in these studies is that FAK is involved in the ability of neuronal cells to survive in suspension. Recently, I have established a novel derivative of the B103 rat neuronal cancer line called, B103-AM, that can survive in suspension. In these cells, which can resist anoikis, levels of FAK protein and levels of FAK phosphorylation will be analyzed through immunoprecipitation, SDS-PAGE, and western blot.

9:15 IDENTIFICATION OF A 0.7kb INSERT FOUND IN *LYMANTRIA DISPAR* MULTINUCLEOCAPSID NUCLEAR POLYHEDROSIS VIRUS FOLLOWING SERIAL PASSAGE. Rachel M. Johnson[1], (Holly J.R. Popham, James M. Slavicek[2],) [1]Ohio Wesleyan University; [2]USDA Forest Service, 359 Main Rd., Delaware OH 43015. rmjohnso@cc.owu.edu

Lymantria dispar Multinucleocapsid Nuclear Polyhedrosis Virus (*Ld*MNPV) is a naturally occurring virus, pathogenic to *Lymantria dispar*, commonly known as the gypsy moth. This virus belongs to the family Baculoviridae, and exhibits the family trait of producing cuboidal or polyhedra-shaped intracellular protein structures that encase infectious virus. Because *Ld*MNPV infects this notorious pest, its genetic characteristics have been studied for future application in biocontrol methods. This virus, which has the tendency to pick up mutations, exhibits the addition of a 700 base pair insert in several isolates after serial passage in cell culture. Because these isolates appear to naturally select for this insert, studies to characterize this 0.7kb area were conducted to determine the advantage it imparts. The possible correlation of this insert to the rate of replication and the amount of apparent budded virus production was examined by comparison of the viral growth curves of isolates with and without the insert (122-fpi, and 122-2 respectively.) This assay showed no differences between the two strains, and no correlation of the insert to either rate of replication or apparent budded virus production. Further study was conducted by restriction enzyme characterization of the area surrounding the insert. In continuing work, this area will be cloned. Furthermore, sequencing of the insert will be performed after it has been subcloned to a suitable size. An analysis of the open reading frames (ORFs) will be conducted to determine how the insert alters existing ORFs or if a new ORF is present. Results will contribute to generating a more stable isolate of *Ld*MNPV, which would be more suitable for biocontrol applications.

9:30 THE EFFECTS OF MECHANICAL, BIOLOGICAL AND CHEMICAL TREATMENT METHODS ON AN INVASIVE PLANT, THE GIANT REED (Phragmites australis). Curt S. Schaeffer, Dr. David A. Francko, Miami University, Dept. of Botany, Oxford OH 45056. mrmustard73@hotmail.com

The native flora of Mentor Marsh, a Lake Erie coastal wetland near Cleveland, OH, is being replaced by an exotic invasive species, *Phragmites australis*. In 1998, we conducted a pilot study that showed that controlling and limiting the spread of this species was possible and seedbank species could re-establish. A 1999 large-scale study was designed to observe the response of *P. australis* to several treatments. Treatment methods were applied as follows: cutting and removal of emerging shoots of *P. australis*, treatment one coupled with application of herbicide and either covering with shade cloth or planting *Typha lattifolia*, and continuous cut and removal of stems. Control plots were left untreated. Stem counts were taken every three or four weeks along with species occurrence, conductivity and water temperature and depth on sixty 9m2 cells. After 15 weeks, control plots and single-cut plots exhibited a mean stem count of 81 +/- 10 /m² and 90 +/- 17 /m² respectively. The multiple cut plots had a mean stem count of 4 +/- 2 /m² and a p-value of > 0.0001. Both single cut and control plots exhibited increasing stem densities up to the end of the growing season, while the multiple cut plot stem densities began to decrease earlier in the growing season. Continuous cut and removal of reed shoots is the most effective method of treatment examined in this study.

9:45 CHARACTERIZATION OF THE Smcy GENE IN THE SPONTANEOUSLY HYPERTENSIVE RAT. Kristina L. Brady, Amy Milsted, University of Akron, Dept. of Biology, Akron OH 44325-3908. kbrady@uakron.edu

The Smcy gene is located on the Y chromosome of many mammals. It encodes a portion of the H-Y antigen that has been found to be responsible for male to female rejections in organ and bone marrow transplantations. It has been hypothesized that the Smcy gene may also be involved in spermatogenesis. The object of the present study is to characterize the rat Smcy gene. Six genomic clones were isolated from the male rat SHR/Akr genomic library, indicating that there is probably only a single copy on the Y chromosome. The Smcy gene is not found in female rats of this same species. It is known that Smcy is widely conserved across species. Homology of the gene can range from 79 to 85 percent. Based on this knowledge, primers for PCR were designed by analyzing gene sequences from other species. The primers we used are found in mice at nucleotides 672-691 and 793-774, suggesting that they should amplify a specific band of around 120 bp. However, we found that these primers amplified a sequence of approximately 300 bp in length. A possible explanation for these results is that there is a difference in splice sites or intervening sequences in the SHR rat as compared to the mouse. This work will help us to better understand gene organization in the spontaneously hypertensive rat, and the relationships among Smcy genes from different species.

10:00 DIFFERENTIAL EXPRESSION OF DIRIGENT PROTEIN GENE HOMOLOGUES IN LOBLOLLY PINE. Jodi E. Creasap*, Aldwin Anterola, Mi Kwon, Laurence Davin, and Norman G. Lewis; *Hiram College, P.O. Box 1211, Hiram OH 44234, and Washington State University. creasapje@hiram.edu

Four dirigent protein gene homologues in loblolly pine were investigated for possible involvement in lignin and lignan formation. Of the four homologues, two were found to be involved in lignin or lignan formation, while the other two were connected with neither process. Measurement of mRNA levels using Real Time Quantitative PCR (RTQPCR) showed that two homologues (8730M and 8811M) are not involved in lignin or lignan formation, since they are found most abundantly in non-lignified areas of the plant and are not involved in lignifying or lignan-forming cell cultures of *Pinus taeda*. In differentiated tissues of the plant, one homologue (9212M) is found 2 to 20 times more than the other predominant homologue (8993M). HPLC analysis of cell suspension cultures from 8% sucrose and 8% sucrose/20 mM potassium iodide media, together with measurement of mRNA levels by RTQPCR, demonstrate that 9212M is associated with the formation of lignans, and 8993M is involved solely in lignin biosynthesis.

10:15 A MOLECULAR ASSESSMENT OF INFRASPECIFIC GENETIC VARIATION IN *DRABA VERNA* L. USING ISSR (INTER-SIMPLE SEQUENCE REPEAT) MARKERS. Michael S. Barker, Denison University, Slayter Box 327, Granville OH 43023. barker_m@denison.edu

Many localized populations of the winter annual *Draba* (*Erophila*) *verna* L. consist of morphologically and cytologically similar individuals. Presumably these similarities are a consequence of obligate self-fertilization. Using ISSR (Inter-Simple Sequence Repeat) markers, I examined infraspecific genetic variation of *D. verna* populations from Indiana, Ohio, and New York. A total of 85 polymorphisms were generated from six ISSR primers. Within each of four populations of *D. verna*, one or two genotypes were detected. UPGMA cluster analyses were used to assess genetic variation among individuals representing 20 populations of *D. verna*. Individuals from Athens County, Licking County, and Erie County, Ohio consist of the same *D. verna* genotype, whereas different genotypes were detected in populations from Athens County, Delaware County, and other sites in Licking County, Ohio. Individual genotypes did not correlate well with geographic distribution, and thus formed a mosaic pattern. This type of distribution is best explained by the lack of a seed dispersal mechanism, which may localize *D. verna* genotypes. Any seed dispersal that occurs may be attributed to human activities, and thus may result in the observed mosaic distribution pattern. Currently, I am examining 100 *D. verna* individuals from the above 20 populations to further assess within-population variation.

10:30 CHARACTERIZATION OF A RAT SHR Y CHROMOSOME CLONE. Michelle Bowman (Dr. Amy Milsted, Bin Zeng), University of Akron, Dept. of Biology, Akron OH 44325-3908. bmichel4@yahoo.com

Previous research has shown that a locus on the Y chromosome increases blood pressure in the spontaneously hypertensive rat (SHR). A suggested candidate for this is Sry, since it encodes a transcription factor and is present in several copies. We are currently searching for these extra copies of Sry. To start, we screened the rat SHR library using a hybridization probe made by amplifying the Sry HMG box from the male DNA with P1/M1 primer set. 19 positive clones were obtained. One of these clones, designated S18?, contains approximately 750 base pairs. Our strategy is to generate a restriction map and to sequence S18? using silver sequencing. The sequence obtained will be used in homology searches of other copies of Sry. A Southern blot will confirm that this particular clone is male-specific (found only on the Y chromosome). The acquired information from S18? will help further our knowledge of the Y chromosome structure and organization.

10:45 THE EFFECTS OF GLYCOSAMINOGLYCAN SUPPLEMENTATION ON PROTEOGLYCAN SYNTHESIS AND CHONDROGENESIS BY HUMAN CHONDROCYTES IN CULTURE. Katherine J. Montgomery, Amy L. Aulthouse, Ohio Northern University, Biology Dept, Ada OH 45810. k-montgomery1@onu.edu

Homeopathic agents reduce inflammation and pain in injured joints and also purportedly stimulate cartilage regeneration, as opposed to prescribed non-steroidal anti-inflammatory drugs (NSAIDs) that prevent cartilage repair by inhibiting chondrocyte metabolism. This study analyzed the effects of glucosamine sulfate, a homeopathic compound, on chondrocyte mitosis and matrix production. Human chondrocytes first grown in monolayer culture were then transferred into an agarose gel culture in order to regain the chondrocyte phenotype. The cells were treated twice weekly with Dulbecco's Modified Eagle Media (DMEM) containing glucosamine sulfate (50mg/ml). Treatment was divided into four schedules: A) parallel untreated control B) treated four weeks consecutively C) treated two weeks then untreated two weeks D) untreated two weeks then treated two weeks. N=10 cultures for all groups except C (N=9). Proteoglycan synthesis was measured qualitatively by staining with alcian blue and comparing the number of cells and cell clusters with and without stained matrix. Mitotic activity was measured by counting the number of single cells versus cell clusters (indicates mitosis). The trypan blue exclusion assay determined cell viability. Comparisons among means were analyzed by ANOVA with LSD multiple comparisons post hoc test ($p<0.05$). An overall trend of decreasing mitosis approached significance between groups A and D ($p_{AD}=0.054$). There was a significant decrease in matrix production between group A and every other group ($p_{AB}=0.035$, $p_{AC}=0.037$, $p_{AD}=0.003$). The nearly identical matrix data from groups B and C ($p_{BC}=0.977$) suggest no recovery from deleterious effects. The results of this preliminary study suggest a decrease in mitosis and matrix production by cells treated with glucosamine sulfate with no recovery, regardless of when the substance is introduced during the culture period.

Molecular Biology II
02:00PM Saturday, April 1, 2000
Meyer Hall Room 126
Carol A. Heckman - Presiding

2:00 RANDOMLY AMPLIFIED POLYMORPHIC DNA MARKERS: CONSERVATION AND MANAGEMENT IMPLICATIONS. Wilson W. Mwanja[1], Les Kaufman[2], Paul A. Fuerst[1], [1] Ohio State University, Dept Evolution, Ecology and Organismal Biology, Columbus OH 43210 and [2]Boston University Marine Program, Dept Biology. Mwanja.673@osu.edu

The fishery of the Lake Victoria basin, dominated by the Cichlidae family of fishes, has suffered significant species loss due to over fishing, lake basin environmental changes, and introduction of non-indigenous species in most of the lakes in the basin. Among species severely affected were two endemic Tilapiine species, *Oreochromis variabilis* and *Oreochromis esculentus* locally known as ngege. Ngege has nearly been extirpated from Lake Victoria and currently survives as small isolated remnant populations in several small satellite lakes in which it was introduced from small brood stocks and coexisting with other introduced more ecologically versatile non indigenous congeners. Of immediate danger is genetic interaction with ngege's sister species, the introduced *Oreochromis niloticus*. In this study, Random Amplified Polymorphic DNA (RAPD) molecular markers were used to examine and characterize the remnant populations of ngege of Lake Victoria basin. Eight primers were used to generate 140 RAPD markers for seven ngege populations. Populations exhibited much higher between-population (H_b = 0.613) than within-population (H_w = 0.152) genetic diversity. Populations exhibited genetic differentiation with characteristic private alleles (29.2%) amongst all the populations. Populations that coexisted with *O. niloticus* showed relatively higher levels of polymorphism as well as gene diversity than those that did not coexist with *O. niloticus*. We suggest protection against interaction with *O. niloticus* in lakes in which *O. esculentus* is dominant or does not coexist with *O. niloticus* yet. With geographically close lakes enhancement of the genetic status of *O. esculentus* through limited gene flow between isolated populations is recommended. (Research was partially supported by grants from the National Science Foundation, The Rockefeller Foundation, and the Pew Charitable Trusts and the Columbus Zoo).

2:15 POTENTIAL TO ENHANCE NODULE OCCUPANCY OF SELECTED IMPROVED RHIZOBIAL STRAINS IN *PHASEOLUS VULGARIS* GROWN IN TROPICAL SOILS. Mari-Vaughn V. Johnson, Ohio University, Dept of Environmental and Plant Biology, Porter Hall, Athens OH 45701. mj355592@ohio.edu

Rhizobia and leguminous plants form a symbiotic relationship, in which the bacteria fix atmospheric nitrogen, making nitrogen accessible to the plant, and the bacteria are afforded protection and energy. A mutant *Phaseolus vulgarus* has been identified, which does not allow nodulation with most strains of rhizobia. However, three permitted strains of rhizobia have been found that will nodulate the restrictive host: USDA9032, USDA9041, and USDA9017. A plasmid containing the Green Fluorescent Protein (GFP) has been inserted into the USDA9032 strain via tri-parental mating; this permits distinction between nodules formed by USDA9032 and those formed by native rhizobia. Soil samples containing native rhizobia were taken from various leguminous crop fields in Belize and Guatemala. Restrictive host plants were grown in the soil samples; plants were inoculated with GFP containing USDA9032 Rhizobia two days after germination. Competition between native rhizobia and USDA9032 is being determined by the ratio of nodules occupied by GFP containing rhizobia compared to those occupied by native rhizobia. The outcome of this experiment will determine the feasability of improving nitrogen fixation in beans by increasing the occupancy of nodules on field grown beans with select rhizobial strains, to the exclusion of resident native rhizobia.

2:30 EXAMINING THE MOLECULAR SIGNALS EXCHANGED BETWEEN A MUTANT *PHASEOLUS VULGARIS* AND SPECIFIC RHIZOBIUM STRAINS. Sarah L. Bashore, Ohio University, Dept. of Environmental and Plant Biology, Porter Hall, Athens OH 45701. sb332892@ohio.edu

Rhizobium species form a symbiosis with leguminous plants. The bacteria fix atmospheric nitrogen for the plant and the plant in turn provides the bacteria with energy and protection. A mutant *Phaseolus vulgaris* was found that restricts nodulation by native rhizobia strains. Laboratory screening showed that three rhizobium strains were able to overcome this mutation and nodulate the plant. The plant exudates of the wild-type host were not able to induce nodulation of the restricted rhizobia strains. Naringenin, a flavonoid that can activate the nod genes, also did not allow for the overcoming of the mutant and the result of nodulation. The steps involved in the nodulation process were examined using Green Fluorescent Protein (GFP). A plasmid with the GFP gene on it was inserted into a permitted strain via tri-parental mating. This allowed visibiiity of each individual bacterium. When the restrictive mutant host was inoculated with restricted strain, no infection threads were seen. This demonstrates that the mutation disrupts the nodulation process some time before infection threads form. This conclusion is supported by the fact that when the permitted strains nodulate the mutant plant they use infection threads. This shows that when the mutant plant is nodulated it utilizes the same processes as the wild-type host. Currently, research is being done to determine which, if any, gene in the permitted strain controls the nodulation of the mutant plant.

2:45 THE EFFECTS OF TISSUE PROPAGAGATION OF COLD HARDY SABAL MINOR WITH PAL INHIBITOR. Katie E. Kettler; Alison L. Boutin; Sarah L. Wilhoite; (Dr. David A. Francko; Dr. Kenneth G. Wilson) Miami University, Botany Dept, Oxford OH 45056. Kettleke@muohio.edu

Growth of palms in different regions has shown that certain species and varieties of palms are more cold tolerant. Breeding experiments have lead to a cultivar of Sabal minor variety Louisiana (Bluestem palmetto), which is more cold tolerant than the wild type variety of S. minor. Tissue experiments have been generally restricted to coconut (Cocos nucefera), date (Phoenix dactylifera), and oil (Elasesis quineenisis) palms. Our ongoing tissue culture experiments are focused on palm growth with the goal of producing more cold tolerant lines. This study focuses on the culture and propagation of the cold tolerant varieties of S. minor variety Louisiana. These plants are cultivated for horticulture use. With our research, we predict that making small changes to already used methods for palm regeneration will help us to produce S. minor variety Louisiana plants. Seeds from S. minor and (Bluestem) palms were taken from plants with know origins. The seeds were soaked in a 10% bleach !solution containing a trace of detergent. Fruit and vegetative tissue was cut into sections and placed in Murashige and Skoog media with varying amounts of hormones. Embryos were also placed in similar cultures. The tissues were kept at a constant temperature of 28° C. The fruits and vegetative parts of the plant turned a dark brown (almost black) color after a period of only a few days. Tissues were then transplanted as needed if contamination occurred. The PAL inhibitor (AIP-2-amino-indan-2-phosphonic acid) was ten introduced to prevent the browning from continuing. Efficiency of the AIP and the cold-tolerance of the two varieties of palms is currently being investigated.

3:00 CHLOROPLAST SPACER DNA SEQUENCES CONFIRM A NORTH AMERICAN-HISPANIOLAN PHYTOGEORAPHIC CONNECTION IN THE *VIOLA MACLOSKEYI* COMPLEX. Bryan J. Rayo and Harvey E. Ballard Jr., Ohio University, Dept. of Environmental and Plant Biology, Porter Hall, Athens OH 45701. br557697@ohiou.edu

New World "stemless white" violets (*Viola* subsection *Stolonosae* Kupffer) comprise nine perennial species of mesic to wet habitats. The *Viola macloskeyi* complex is representative of the group and consists of *V. macloskeyi* Lloyd ssp. *macloskeyi* in California and southwestern Oregon, transcontinental *V. macloskeyi* ssp. *pallens* (Ging.) Hitchc., and *V. domingensis* Urban of marshy openings in Dominican Republic cloud forests. Recent phenetic studies have failed to separate *V. macloskeyi* ssp. *pallens* from the Hispaniolan "endemic" but sharply distinguish *V. macloskeyi* ssp. *macloskeyi* from this aggregate. Geographic variation has been recovered from *trn*T-*trn*F chloroplast spacer sequences for both populations and taxa in the complex. Midwestern *V. macloskeyi* ssp. *pallens* and *V. domengensis* are virtually identical but diverge from northeastern and western North America populations, and from *V. macloskeyi* ssp. *macloskeyi*, supporting phenetic results that *V. domingensis* is synonymous with, and a component of, *V. macloskeyi* ssp. *pallens*. Molecular data suggest a long-distance dispersal event to Hispaniola during the Pleistocene or early Holocene, perhaps from populations presently represented in the southern Appalachians. Future research will access Inter-Simple Sequence Repeat variation in eastern North American and Dominican Republic populations to refine the biogeographic source area and compare genetic differentiation in the two regions. Approximately a dozen other angiosperm groups inhabit Antillean cloud forest openings as well as wetlands in temperate North America. Molecular phylogeographic investigations of the *V. macloskeyi* complex will hopefully clarify evolutionary events underlying a hitherto unappreciated North American-Antillean relationship integral to the formation of cloud forest wetlands in the Greater Antilles.

3:30 A MOLECULAR PHYLOGENY OF *CORALLORHIZA* (ORCHIDACEAE) AND RELATED GENERA BASED UPON THE INTERNAL TRANSCRIBED SPACER (ITS) REGION OF NUCLEAR RIBOSOMAL DNA. Diana M. Senyo[1], John V. Freudenstein[2], [1]Kent State University, Dept. of Biological Sciences, Kent OH 44242 and [2]Ohio State University, Dept. of Evolution, Ecology and Organismal Biology. dsenyo@kent.edu

Corallorhiza Gagnebin (Orchidaceae) is comprised of eleven species of leafless, rootless, mycotrophic orchids. Closely related genera (*Aplectrum*, *Cremastra*, and *Oreorchis*) all possess leaves and roots. Because *Corallorhiza* is characterized by loss of structure, morphological evidence provides only weak support for the monophyly of the genus. Reduced numbers of morphological characters have also made phylogenetic reconstruction within the genus difficult. ITS sequences were generated for multiple accessions of *Corallorhiza* (representing 8 of 11 spp.), *Aplectrum* (1 of 1 sp.), *Cremastra* (2 of 2 spp.), and *Oreorchis* (1 of 16 spp.), for use in cladistic analysis. *Govenia* was used as outgroup. Data were obtained using PCR methods and automated sequencing, and analyzed using parsimony. Molecular characters provide support for the monophyly of *Corallorhiza*. Relationships suggested among the genera are: *Aplectrum* (*Cremastra* (*Oreorchis*, *Corallorhiza*)). Within *Corallorhiza*, relationships among species are largely congruent with previous phylogenetic hypotheses, with the exception that *C. mertensiana* and *C. bulbosa* appear to have been derived from within *C. maculata*. Previous hypotheses have been (*C. bulbosa* (*C. maculata*, *C. mertensiana*)). *C. bentleyi*, a newly found West Virginian species, falls among populations of *C. striata*. The chloroplast gene *psb*A was amplified to determine if size changes have occurred in this gene among these taxa. Changes in plastid genes are known to occur in heterotrophic plants. Relative to the other four genera, six of the *Corallorhiza* species displayed size deletions of ca. 100 bp. Two other species, *C. striata* and *C. bentleyi*, displayed greater size deletions ranging from ca. 100-700 bp.

3:45 PMA INDUCED DOWN REGULATION OF SPECIFIC PROTEIN KINASE C ISOZYMES AT VARIOUS TIME INTERVALS. Carol A. Heckman and Jason M. Urban, Bowling Green State University, Dept. of Biological Sciences, Bowling Green OH 43403. heckman@bgnet.bgsu.edu

We investigated the possible role of protein kinase C (PKC) in mediating morphological changes in the rat tracheal cell line, 1000W. When treated with phorbol 12-myristate 13-acetate (PMA) these cells undergo similar actin-based changes as those mediated by Rho-family G-proteins. Previous results revealed that PMA treatment stimulates ruffling at the 2-5 hour interval possibly due to the down-regulation of certain PKC isozymes by phorbol esters. The purpose of this work was to determine whether any isozymes were depleted at the interval when ruffling peaks. Six isozymes known to be present, PKC $\alpha,\beta,\delta,\varepsilon,\gamma$, and$\zeta$, were quantified. Cell cultures were treated with PMA and collected at 0, 0.5, 2, 5, 10, and 15 hours. Isozyme presence was determined by immunoprecipitating PKC with specific antibody and running the precipitated protein on SDS-PAGE, followed by measuring protein content from gel bands (GelPro© analyzer). There was a marked decrease in intensity in PKC-ε after 5 hours, and later, PKC-β was also down-regulated. PKC-α and PKC-γ displayed the same variations in down-regulation; decreasing, increasing, and decreasing at 5,10 and 15 hours respectively. The remaining isozymes ($\delta$and ξ) displayed a constant intensity. It may be possible that the down-regulation of PKC-α,β,ε and γ are individually or collectively responsible for an increase in ruffling activity.

4:00 ARE MUTATIONS RESPONSIBLE FOR THE DIFFERENCES IN mRNA LEVELS OF THE RENIN AND ANGIOTENSINOGEN GENES IN RATS WITH THE SAME GENETIC BACKGROUND? Ashwini Viswanathan, Amy Milsted, University of Akron, Dept. of Biology, Akron OH 44325-3908. ashwin@uakron.edu

In a study conducted earlier to evaluate whether renin and angiotensinogen gene expression in females from two strains of rats (WKY and SHR/y) that share the same autosomes and X chromosomes differs, it was found that the renin and angiotensinogen mRNA levels differ between the strains and appear to be regulated coordinately within each strain. A possible explanation is that a mutation in renin and angiotensinogen genes has occurred in one strain, but not in the other, or that some factor that co-regulates expression of both renin and angiotensinogen mRNA has undergone a mutation in only one strain. Our hypothesis is that mutations have not occurred in the 18 generations since the SHR/y strain was developed (from the parental WKY strain). We are investigating whether mutations have occurred in the coding sequences or in the regulatory regions of these genes. We designed 13 primer sets for renin and 8 primer sets for angiotensinogen to cover the entire protein-coding region of each gene. Results of this study are expected to rule out mutations in renin and angiotensinogen as the cause of the phenotypic differences in gene expression between the WKY and SHR/y females. When I compared the first 101 base pairs obtained by sequencing to already existing sequences of the rat angiotensinogen gene I found 100% homology. Therefore it proves that mutations may not be the reason for the differences in mRNA levels in genetically similar rats. Depending on these results we may also sequence into the regulatory regions.

4:15 EXTRACTION OF *ACANTHAMOEBA* SP. DNA FROM PARAFFIN-EMBEDDED CORNEAL TISSUE SECTIONS. Joe Wernet, Katherine Osborn, Barbara Fink, Greg Booton, David Wilke, Paul Fuerst, and Thomas Byers. Ohio State University, Dept. of Molecular Genetics, 484 W. 12th Avenue Columbus OH 43210. Wernet.3@osu.edu

Amoebae in the genus *Acanthamoeba* are the cause of an eye disease *Acanthamoeba* keratitis. This occurs primarily in soft contact lens users. The amoeba can colonize tissue, causing a painful, and potentially sight threatening infection which is difficult to treat. Effective treatment depends upon accurate diagnosis. As part of a study to examine the effect of excimer phototherapeutic keratectomy on *Acanthamoeba* keratitis (AK) in infected Chinese hamsters, fixed and paraffin-embedded corneal tissue sections were examined for the presence of *Acanthamoeba* DNA. These hamster corneas were previously inoculated with *Acanthamoeba* and appeared to be severely infected when later examined using a slit lamp procedure. However, no *Acanthamoeba* were specifically observed. Therefore, to determine if the Chinese hamster AK cases were in fact the result of *Acanthamoeba* infection, and that they were present in corneal tissue, extraction of total DNA from multiple sectioned samples was attempted. In addition, DNA extraction was attempted from fixed, paraffin-embedded, non-sectioned hamster corneas. Following extraction, polymerase chain reaction (PCR) amplification using *Acanthamoeba* specific, and universal, primers will be performed. Results from these experiments will be discussed in this presentation.

4:30 THE EFFECT OF PAL INHIBITOR ON THE TISSUE CULTURE OF *TRACHYCARPUS FORTUNEI* AND *TRACHYCARPUS TAKIL* PALMS. Alison L. Boutin; Katie E. Kettler; Sarah L. Wilhoite; (Dr. Kenneth Wilson; Dr. David Francko), Miami University, Botany Dept, Pearson Hall, Oxford OH 45056. boutinal@muohio.edu

Palms have potential of producing cold tolerant lines beneficial for horticultural use. Several current tissue culture projects are focused on developing a means for palm propagation. With most palm tissue grown in culture, browning occurs very quickly. Browning is due to a phenolic pathway that produces degradation of cell wall material. A novel phenylalanine ammonia-lyase (PAL) inhibitor has been shown to be effective in preventing browning in tissue culture of red cabbage and duckweed. This project's objective is to test the same for palms. To yield the best regeneration tissue cultures of *Trachycarpus fortunei* and *Trachycarpus takil*, samples were grown in media containing varied hormone ratios. During the browning stage of the tissue cultures' growth, the PAL inhibitor was used. The PAL inhibitor tested in this study consists of 2-amino-indan-2-phosphonic acid (AIP). The effectiveness of the PAL inhibitor on browning in palm tissue culture as well as overall effectiveness of the regeneration of the samples will be evaluated.

4:45 TISSUE CULTURE PROPAGATION OF COLD-HARDY SABAL PALMETTO PALMS. Sarah Wilhoite, Alison L. Boutin, Katie E. Kettler, (David A. Francko, Kenneth G. Wilson), Miami University, Dept. of Botany, Pearson Hall, Oxford OH 45056. wilhoisl@muohio.edu

Field trial investigation into the cold-hardiness of palms have shown that some species are viable in temperate regions. Tissue culture propagation of palms that exhibit enhanced cold tolerance may permit rapid production of cold tolerant lines for horticultural use. Previous research in palm tissue culture has been limited to *Cocos nucifera*, *Phoenix dactylifera* and *Elaesis quineensis*. We predict that slight adjustments in published methods for palm embryo tissue culture will be applicable to mass propagation of *Sabal palmetto*. Seeds of a cold tolerant and a wild type *Sabal palmetto* were surface sterilized in a 10% bleach solution containing a trace of detergent. Embryos were then removed and placed in petri dishes on Murashige and Skoog media with varying amounts of hormones and kept at 28°C. Observations are being made regarding the success of embryogenesis among the varying cultures. Cold tolerance screening of propagated palm tissue is under investigation.

PLANT SYSTEMATICS
09:00AM SATURDAY, APRIL 1, 2000
MEYER HALL ROOM 128
SHYA CHITALEY- PRESIDING

9:00 SYSTEMATICS, BIOGEOGRAPHY, AND EVOLUTIONARY TRENDS IN THE NORTH AMERICAN SPECIES OF *FROELICHIA* (AMARANTHACEAE). Ross A. McCauley and Harvey E. Ballard Jr., Ohio University, Dept of Environmental and Plant Biology, Athens OH 45701. rm373190@ohio.edu

As it is currently circumscribed, *Froelichia* Moench. is a genus of 15-20 species of annual and perennial herbs and shrubs which inhabit dry plains and coastal areas of the tropical and subtropical western hemisphere and temperate North America. This group is closely related to *Gomphrena* (Globe Amaranth) and *Alternanthera*, both planted ornamentally in North America. This work is part of a larger project to survey the genus with the goal of determining species boundaries and determining phylogenetic relationships within the group. As a portion of this work, the North American species are here reviewed using a series of morphological and Internal Transcribed Spacer DNA datasets to distinguish species and reconstruct phylogenies. Preliminary analysis suggests there are four distinct species with one showing wide-ranging varietal distinctions. This is a reduction from the eight species once recognized for the region. The greatest species diversity and abundance occurs in the southwestern United States and northern Mexico where the species ranges all overlap. An apparent radiation occurred in a northward and eastward direction from this region distributing the genus in sand prairies over much of the Great Plains, the Midwest, and the southeastern coastal plain. Recent human introductions primarily along railroads in the early to mid-1900s, have expanded the range of a widespread weedy species, *F. gracilis* (Hooker) Moq. north and east to southern Ontario and the New England states. Two of the species, *F. gracilis* and *F. floridana* (Nutt.) Moq. occur in isolated localities here in Ohio.

9:15 A SYSTEMATIC STUDY OF THE NORTH AMERICAN YELLOW LADY'S SLIPPER ORCHIDS. Julie A. Morris and John V. Freudenstein, Kent State University, Dept. of Biological Sciences, Kent OH 44242. jamorris@kent.edu

The North American Yellow Lady's Slipper Orchids (*Cypripedium*) and their relatives present a large amount of variation that has caused significant taxonomic confusion when relying on morphological characters alone. In this study, the group was investigated using inter-simple sequence repeat (ISSR) markers. Samples were taken from multiple populations of *C. parviflorum* var. *parviflorum* and *C. parviflorum* var. *pubescens* sampled from across their ranges, as well as from populations of *C. kentuckiense*, *C. candidum* and *C. montanum*. One population of *C. californicum* was included for outgroup comparison. Individuals were scored for the presence or absence of bands for 8 ISSR primers, and the data were analyzed cladistically using parsimony, and phenetically using UPGMA and neighbor-joining. The relationship of the ISSR patterns to variations in floral morphology was also investigated. Populations of *C. pubescens* and *C. parviflorum* are intermixed in all of the analyses with very few patterns relating to morphological differences or geographic locations. This could mean that they should not be treated as distinct and that morphological groupings are based on convergences, or that they are experiencing secondary hybridization. Populations of *C. kentuckiense* fall out in two clades associated with two different populations of *C. pubescens*. This could also be due to convergent evolution or occurrences of secondary hybridization. The distinctness of *C. candidum* and *C. montanum* from the rest of this clade is well supported.

9:30 EVOLUTIONARY RELATIONSHIPS AMONG SPECIES OF TROPICAL LIANAS: ASSEMBLING A MOLECULAR PHYLOGENY OF TRIBE BIGNONIEAE (BIGNONIACEAE). Andrew C. Robie, Warren D. Hauk, Denison University, Slayter Box 1811, Granville OH 43023. robie_a@denison.edu

Bignoniaceae are a pantropical family of flowering trees and lianas with a center of diversity in the New World tropics. Bignonieae, the largest of the eight tribes in the family, is an ecologically vital component of tropical wet and dry forests in Central and South America. The lack of definitive morphological characters, compounded by the large number of species in the tribe, has led to controversy surrounding traditional classification systems. Currently, there is no well-developed hypothesis regarding evolutionary relationships within Bignonieae. We assembled a molecular phylogeny for 18 representative members of the tribe and 11 outgroups based on the internal transcribed spacer (ITS) regions of nuclear ribosomal DNA in order to 1) confirm the tribe's monophyly, 2) gain a general understanding of the evolutionary relationships among genera of Bignonieae, and 3) support the monophyly of genera within the tribe. In preliminary analyses, monophyly of Bignonieae was supported with a 74% bootstrap value based on a strict consensus phylogeny from 18 most parsimonious trees for 18 ingroups and 11 outgroups. We identified two distinct clades within the tribe which may differ in diversity of pollination syndromes. One clade is composed of taxa pollinated by bees alone, whereas the second contains taxa with a more diverse group of pollinators including bees, sphyngid moths, and hummingbirds. The monophyly of genera *Anemopaegma*, *Memora*, and *Arrabidaea* was established with bootstrap support of 100%, 71%, and 66% respectively.

9:45 LYCOPSIDS FROM THE LATE DEVONIAN CLEVELAND SHALE OF OHIO, USA. Shya Chitaley, The Cleveland Museum of Natural History, 1 Wade Oval, University Circle, Cleveland OH 44106-1767. schitale@cmnh.org

Several outcrops of Cleveland Shale are explored for their paleobotanical contents. Outstanding in the fossilized plants are the remains of lycopods (club-mosses) here called lycopsids in general. They belong to the group of vascular plants named Pteridophyta.These remains are found as compressions, exposing the morphological features in the case of tree bark. They were studied with incident light under high magnification using a sterio microscope. For this study, the compressions were first washed gently with water and then cleared with HCL, HF, and HNO3, one after the other (using a water wash after every transfer) in the same order to dissolve the minerals like Calcium, Silica and Pyrite from the shaly matrix. Also transfers were tried on cellulose acetate film from the cleared surfaces of the specimens. It was observed that the features on the bark are varied into ten different patterns suggesting the variety of lycopsid trees grown in the wet coastal forests around the Late Devonian Ohioan Sea.

10:00 CHARLES WILKINS SHORT'S "BOTANICAL MEMORANDA" (1833-1840). Ronald L. Stuckey. The Ohio State University, Museum of Biological Diversity, 1315 Kinnear Rd, Columbus OH 43212-1192.

Medical botanist, Charles Wilkins Short (1794-1863), is best known for his pioneering floristic studies of Kentucky, and for his well-prepared collections of dried plants, which he distributed to over 75 botanists throughout the world. This paper presents an analysis of his 49-page handwritten manuscript of "Botanical Memoranda" prepared during his most active years of fieldwork, when he was exchanging massive quantities of specimens with his correspondents. Short's manuscript consists mostly of descriptive notes about plants, places visited, weather conditions, topographic features, names of people, trip costs, and miles traveled on his field excursions throughout parts of Kentucky. To make Short's unpublished "Botanical Memoranda" useful to botanists of the twenty-first century, annotations are prepared as appendices. For example, (1) The 213 plant names are provided with their present-day equivalents, (2) explanatory notes are added for 80 items referring to names of mostly people and places, and (3) eight species are recorded as rare, six from only one locality, and six seen for the first time. With renewed interest in the production of local, state, and national floras fostered through environmental, conservation, and educational efforts, knowledge from field notes of past plant surveys are important sources necessary for understanding floristic changes.

Plant Physiology and Ecology
02:00PM Saturday, April 1, 2000
Meyer Hall Room 128
David A. Francko - Presiding

2:00 GERMINATION AND DORMANCY OF THREE INLAND HALOPHYTE SPECIES. Christy T. Carter and Irwin A. Ungar, Ohio University, Dept. of Environmental and Plant Biology, Porter Hall, Athens OH 45701. ct346390@ohio.edu

Collections of *Spergularia marina* seeds, and large seeds (>2 mm) of *Atriplex prostrata* and *Salicornia europaea* were made in October, 1998, in an inland salt marsh in Rittman, Ohio. Seeds were buried in polyester bags, buried in the soil, and harvested monthly to assess germinability. Replicates were placed in four temperature regimes (20:35, 5:25, 15:25, 5:15°C) and received 12-h dark/12-h light (20 μmol/m²/s, 400-700 nm). A second set was placed in metal containers to simulate darkness. Fresh seeds of *S. europaea* germinated in light and dark at all thermoperiods. The highest germination occurred in the 20:35°C thermoperiod and the lowest occurred in the 5:15°C thermoperiod in both light and dark treatments for fresh seeds and exhumed seeds. Fresh seeds of *A. prostrata* exposed to light had highest germination (87%) in the 20:35°C thermoperiod and the least (0%) in the 5:15°C thermoperiod. No fresh seeds of *A. prostrata* germinated in darkness except in the 20:35°C thermoperiod (4%). Exhumed seeds May, of *A. prostrata* germinated (>75%) in all thermoperiods in light and dark. By 1999, 83% of *A. prostrata* and 94% of *S. europaea* seeds germinated in the ground. No fresh seeds of *S. marina* germinated in light or dark. Exhumed seeds of *S. marina* had greater than 75% germination in the 5:15°C thermoperiod and less than 6% germination in the 20:35°C thermoperiod. Less than 4% of exhumed seeds germinated in darkness. *Spergularia marina* and large *A. prostrata* seeds have nondeep physiological dormancy while large seeds of *S. europaea* are nondormant.

2:15 FACTORS AFFECTING GERMINATION RATES OF *LUPINUS PERENNIS*. Katie C. Abell and Dr. Helen Michaels, Bowling Green State University, Dept of Biological Sciences, Bowling Green OH 43402. kabell@bgnet.bgsu.edu

Lupinus perennis, sole food source for the larval form of the endangered Karner Blue butterfly, is a vital part of a vanishing prairie ecosystem in northwest Ohio, the Oak Savannah. The project reported in this paper is part of a series of studies which have explored factors effecting germination of the Oak Savannah native, *L. perennis*. Specifically, this research investigated the fitness levels of six discrete *Lupinus perennis* populations, which have diverse combinations of conditions caused by environmental and human factors. Because of these differences, *Lupinus perennis* populations will have varying levels of fitness with respect to germination. Each population contributed 75 seeds, which were divided into six repetitions of 15 seeds. The seeds were subjected to a 60 hour stratification period and placed in a randomized block design in the growth chamber. Data were analyzed using a Kruskal-Wallis one-way ANOVA which indicated that there was a significant differences in germination rates among the populations at the 12 hour measure ($p=.041$). This finding indicates that differences exist in fitness levels with respect to germination among the six different populations that were investigated in this study. These differences indicate that one or many of the environmental factors are influencing the fitness levels of the populations. However, all populations probably will be different from each other simply because *L. perennis* can grow in differing environments. Caution is recommended when seeds from multiple populations will be used in a single study because the seeds may have significantly different levels of germination.

2:30 SOIL SEED BANK AND ABOVEGROUND VEGETATION IN CLEARCUT AND MATURE OAK-HICKORY FORESTS OF SOUTHEASTERN OHIO. Christine J. Small, Brian C. McCarthy, Ohio University, Dept of Environmental and Plant Biology, Athens OH 45701. cs225388@ohio.edu

Studies suggest that seed banks play a vital role in forest recovery following meso-scale disturbance. However, few studies have focused on seed banks of eastern deciduous forests, particularly relative to site conditions and anthropogenic disturbance. Our objective was to examine the influence of harvesting and topography on seed bank (SB) and understory (US) composition in oak-hickory forests of southeastern Ohio. We established 192-2.5 m² quadrats in regenerating clearcut (CC; < 10 yr) and mature second-growth (SG; > 125 yr) stands of similar aspects. In each quadrat, US vegetation was sampled in spring and summer 1998. SB samples (1,000 cm³) were collected in winter 1999 for greenhouse germination. US richness was greater in CC than SG quadrats (total S = 117 vs. 103; mean S = 14.69 vs. 12.80 ($P < 0.05$), respectively). SB richness was also greater in CC than SG samples (total S = 48 vs. 45; mean S = 2.69 vs. 1.87 ($P < 0.01$), respectively). Stand age showed the strongest influence over composition, with extremely low similarity of CC and SG samples (< 5%). Similarity between US and SB composition was low in both CC and SG (< 30%). Aspect also influenced composition in CC and SG, with strong divergence of N- and S-slope samples (< 40% similarity). Our results support others indicating low US-SB similarity and decreasing SB richness with forest succession. The strong influence of disturbance and aspect on these strata emphasizes the importance of site conditions to forest recovery following disturbances such as clearcutting.

2:45 BIOMASS ALLOCATION AND RESPROUT ABILITY OF PRINCESS TREE (*PAULOWNIA TOMENTOSA*) ACROSS A LIGHT GRADIENT. A. Christina Williams and Brian C. McCarthy, Ohio University, Dept of Environmental and Plant Biology, Athens OH 45701. aw371587@ohio.edu

Acclimation of woody plants to low light environments may interfere with their ability to resprout. We examined the patterns of biomass allocation and resprout ability of *Paulownia tomentosa* (Scrophulariaceae), an r-selected species, in three light environments. Plants were grown in shade houses in a common garden with two replicates of three light treatments: ambient light, artificial edge, and shade. The shade treatment mimicked light patterns and levels typical of a deciduous forest understory. The artificial edge provided an intermediate light regime. Seedlings were clipped to ground level and representative plants were harvested periodically over the growing season. Plants allocated more to below-ground biomass in the first weeks of the experiment and then shifted allocation to above-ground biomass. Plants grown in shade had lower relative growth rates (RGR) and higher specific leaf area (SLA), leaf area ratio, and leaf weight ratios than plants in the other light treatments. The ability to resprout was shown to be influenced by the amount of accumulated below ground biomass and since this was lowest in the shade treatment, resprouting was reduced in low light. *P. tomentosa* responded holistically to the stresses of light and artificial grazing treatment. A pattern of increased root to shoot ratio with increased light follows that found in other studies. However, increased SLA was not correlated to an

increase in RGR. Also, correlation networks showed decreased integration in the stressful environment (shade). These results are contrary to previous studies of short-lived annuals, perhaps because *P. tomentosa* is a long-lived heliophile.

3:00 ANATOMY AND ELEMENT LOCATION IN ROOTS OF SUGAR MAPLE SEEDLINGS FROM LIMED AND UNLIMED FOREST SITES. Carolyn J. McQuattie[1], Robert P. Long[1], Thomas Hall[2], [1]USDA Forest Service, 359 Main Rd, Delaware OH 43015 and [2]Pennsylvania Bureau of Forestry. cmcquatt/ne_de@fs.fed.us

Poor survival of sugar maple (*Acer saccharum* Marsh.) seedlings on acidic forest soils in north- central Pennsylvania may be due in part to the acidity or chemical composition of the soil. Lime application to these soils results in significantly greater survival of sugar maple seedlings. Anatomy, mycorrhizal colonization, and element microdistribution in roots of sugar maple seedlings from a limed soil (pH 5.4) and a nearby unlimed soil (pH 3.8) were compared. In 1996 and 1998, ten seedlings were collected from both soils in June and August. Representative fine roots from each root system were chemically fixed and resin-embedded for light and electron microscopy or quench-frozen and freeze substituted for X-ray analysis. The remaining portion of each root system was stained for mycorrhizal assessment. At all collection times, mycorrhizal colonization was significantly greater in roots from limed than from unlimed soil. In mycorrhizal root segments, fungal hyphae generally filled cortical cells of roots from the limed soil but were sparse in root cells from the unlimed soil. In June, roots from unlimed soil were more irregular in cross section and contained more dense compounds in endodermal cells than roots from the limed soil. In roots from the unlimed soil only (June 1996 collection), precipitates in xylem and cortical cells contained Mn, while Al was detected in mycorrhizal hyphae. Seedlings from the unlimed site exhibited indicators of stress: low mycorrhizal colonization, increased root cell deterioration, and the presence of potentially toxic elements (Mn, Al) in root or fungal cells.

3:15 DENDROCHRONOLOGICAL ANALYSIS OF WHITE OAK (*QUERCUS ALBA* L.) RADIAL GROWTH PATTERNS ACROSS A TOPOGRAPHIC MOISTURE GRADIENT IN SOUTHERN OHIO. Darrin L. Rubino and Brian C. McCarthy, Ohio University, Dept of Environmental and Plant Biology, Athens OH 45701. dr246988@ohio.edu

Annual tree growth represents an aggregate response to numerous biotic and abiotic factors. Understanding how these factors influence growth rates is a major objective of dendrochronological or tree-ring studies. The goal of this investigation was to determine the influence of moisture availability and climate on radial growth patterns of white oak growing in mixed-oak forests of southern Ohio. Using accurately dated and measured tree rings, we analyzed 120 white oaks growing across an integrated moisture index (IMI). IMI is a computer-generated GIS model which combines topographic and edaphic features into a moisture index scale. To observe radial growth patterns across IMI classes (xeric, intermediate, and mesic), we modeled tree growth using orthogonal polynomials. Radial growth trends were significantly greater (ANOVA; $P = 0.005$) in mesic sites than in xeric sites. Decadal radial-growth trend analysis revealed significant ($P < 0.05$) differences in growth rate among the various IMI classes, but consistent patterns were not observed among all decades. Climatic analysis found annual growth increments to be significantly ($P < 0.05$) correlated with monthly drought severity, precipitation, and temperature. The number of significant correlations between climatic parameters and annual growth varies among the IMI classes and thus suggests that climate-growth relationships vary across IMI. Growth rates during years of drought and high precipitation also differed significantly across IMI, but no consistent pattern was noted among the different IMI classes. We hypothesize that radial growth and IMI may be loosely associated, but other factors may have a greater influence on radial growth rates.

3:30 LANDSCAPE CULTIVATION OF COLD-HARDY PALMS IN SW OHIO: MICROCLIMATE INFLUENCES. David A. Francko and Sarah Wilhoite, Miami University, Dept. of Botany, Oxford OH 45056. franckda@ muohio.edu

Survivorship/growth of several cold-hardy palm species was evaluated at the Hardy Palm Demonstration Plot (HPDP) of Miami University (39°30' N) and in home garden plots a few km southwest. Oxford lies within USDA Plant Hardiness Zone 6a, but data on 1998-99 daily temperatures and winter minima for 1989-99 demonstrated that microclimates vary from Zone 6a in open, rural areas to Zone 7a/b in sheltered areas on campus. In the HPDP (Zone 7a microclimate), 2 to 3 year-old seedlings of *Rhapidophyllum hystrix* (needle palm; N = 7), *Sabal minor* (dwarf palmetto; N = 6), *Trachycarpus fortunei* (Chinese windmill palm; N = 7), and *Sabal palmetto* (cabbage palm; N = 4), and larger 10-gal specimens of windmill palm and needle palm (N = 2 ea) were established in summer 1998. Replicate plantings were sited in Zone 6a and 6b microclimate plots in the home garden. Winter protection was minimal (burlap windscreens, pine straw mulching, antidessicant spray to leaves). Despite a severe winter (minimum temp in rural Oxford = -14° F, minimum temp at the HPDP = -2° F; 3 weeks continuous snow cover in Jan 1999) only one plant was lost to winter injury. A larger *Trachycarpus* specimen exposed to -10° F in the home garden was defoliated but recovered to produce a full canopy of leaves by summer 1999. Remaining plants experienced tip/margin burn and all plants grew extensively during the 1999 growing season. In spring 1999, the HPDP was expanded and several new Zone 6a - 7a microclimate plots were added on campus, in the home garden, and elsewhere in Oxford, with the above palms plus additional species (pindo palm, saw palmetto, Bermuda sabal palm, Himalayan windmill palm, California fan palm; N = over 100 plants). The collective data suggest that many palms can be grown successfully in southern Ohio with minimal winter protection.

3:45 POTENTIAL REDISTRIBUTION OF TREE SPECIES UNDER CLIMATE CHANGE IN THE EASTERN UNITED STATES. Louis R. Iverson, Anantha M. Prasad, USDA Forest Service, Northeastern Research Station, Delaware OH 43015. liverson/ne_de@fs.fed.us

Global climate change could have profound effects on the earth's biota, including large redistributions of tree species and forest types. We used DISTRIB, a deterministic regression tree analysis model, to examine environmental drivers related to current forest-species distributions and then model possible future distributions under five climate-change scenarios associated with a doubling of atmospheric CO_2. Potential shifts of 80 common tree species in the eastern United States were evaluated based on more than 100,000 plots and 33 environmental variables related to climate, soils, land use, and elevation. Regression tree analysis was used to devise prediction rules from current species-environment relationships. These rules were used to replicate the current distribution and predict the future potential distributions for more than 2,100 counties east of the 100th meridian. About 35 tree species were projected to expand in range and/or importance by at least 10%; 31 species could decrease in range/importance by at least 10%. Several species (*Populus tremuloides, P. grandidentata, Acer saccharum, Betula papyrifera, Thuja occidentalis*) could be extirpated from the United States. The five scenarios generally were in agreement with respect to trends in potential future distributions. Actual species and forest-type redistributions will be controlled by migration rates attainable through fragmented landscapes, another area of active research.

Aquatic Biology I
09:00AM Saturday, April 1, 2000
Meyer Hall Room 113
Susan Carty - Presiding

9:00 BACTERIAL AVAILABLE PHOSPHATE (BAP) - A NOVEL APPROACH TO ESTIMATE AMBIENT PHOSPHATE CONCENTRATION IN FRESHWATER COMMUNITIES. Xueqing Gao and R. T. Heath, Kent State University, Kent OH 44242. xgao@kent.edu

The concentration of phosphate is known often to control phytoplankton growth in freshwater communities, but estimation of the concentration of this critical nutrient is uncertain, and estimates often range over two orders of magnitude. Here we propose a novel approach to determine ambient phosphate concentration through examination of bacterial phosphate uptake, known to be responsible for most of the community phosphate uptake. Velocity of net uptake of phosphate was estimated from the bacterial growth rate (3H-thymidine and 3H-leucine methods) minus losses due to release and grazing. Using radiometric procedures we found only insignificant losses of phosphate by release and by grazing. BAP was estimated from velocity/k, where k is the proportional uptake rate constant. We assumed there was no discrimination between 31P- and 32P-phosphate. We found that in most cases, BAP was lower than estimates from both soluble reactive P (SRP) test and Rigler's bioassay. This suggests that the majority of SRP may not be available to bacteria and that Rigler's bioassay estimate was only an upper limit. This study was supported by Ohio Sea Grant R/ER-43.

9:15 MICROBENTHIC CARBON DYNAMICS IN THE OLD WOMAN CREEK COASTAL WETLAND. John A. McGreevy and Robert T. Heath, Kent State University, Dept of Biological Sciences, Kent OH 44240-0001. jmcgreev@kent.edu

Previous observations of field samples indicated the relationship between benthic bacteria and their protistan grazers was unclear. The purpose of this study was to determine whether benthic bacterial productivity was controlled through resource availability (i.e. "bottom-up" control) or protistan bacterivorous grazing (i.e. "top-down"). We conducted field observations and laboratory experiments to examine the interrelation of organic carbon (NOM detection by hot catalytic method), benthic bacterial numbers (acridine orange staining), bacterial productivity ([3H]-leucine method), protistan numbers (live counts) and protistan grazing rate (fluorescently-tagged sediment). Sites at Old Woman Creek N. E. R. R, Huron, OH, differed in presence or absence of the macrophyte *Nelumbo lutea* (American water lotus). Laboratory sediment microcosms differed in the amount of dissolved organic carbon (buffered acetate) added or by different numbers of *Nelumbo* leaf disks placed on their surface. In both field and laboratory observations bacterial numbers and productivity increased as organic content increased. Benthic protistan bacterivory accounted for only minor losses of bacterial production (typically < 1 %). We conclude that benthic bacterial productivity and numbers were controlled through "bottom-up" rather than "top-down" processes. This study was supported by Ohio Sea Grant R/ER - 37.

9:30 VARIATIONS IN EPIPHYTIC DIATOM POPULATIONS OF *NELUMBO LUTEA* AT OLD WOMAN CREEK. Sharon E. Reed (Dr. Susan Carty), Heidelberg College, Biology Dept, 310 E. Market St, Tiffin OH 44883. sreed2@heidelerg.edu

The studies of host specificity and population dynamics have produced contradictory results. Diatoms were scraped from *Nelumbo lutea* in Old Woman Creek Estuary during June, July, and August of 1999. These samples were cleaned and then viewed at 1000x magnification to determine the genus and species. This study investigates three different aspects of these issues. First, it reveals which epiphytic diatoms occur on the plant

Nelumbo lutea in Old Woman Creek National Estuarine Research Reserve. Second, it makes a spatial comparison of populations at the inlet of the estuary compared to the outlet. Third, it explores the temporal variation of diatoms living on *Nelumbo lutea* from two sites collected in 1983 and 1999. The dynamics of the population are explored to seek out future areas of research to explain variations in populations.

9:45 EFFECTS OF DIFFERENT VEGETATIVE SUBSTRATES ON ALGAL COMPOSITION IN VERNAL POOLS. Robert G. Verb, Dale A. Casamatta, and Morgan L. Vis, Ohio University, Dept. of Environmental and Plant Biology, Athens OH 45701. rv359690@ohio.edu

Vernal pools represent one of several types of temporary aquatic habitats found in Ohio. These may occur as ephemeral mesohabitats in a wide variety of community types. Field observations identified four types of vernal pools from community types throughout southeastern Ohio. For this study, pools were categorized by the type of dominant plant material composing their substrate. The categories were as follows, 1. Emergent macrophytes (M); 2. Mixed deciduous forest leaves and debris (F); 3. *Pinus* spp. needles (P); 4. Old field herbs (OF). A study was designed to examine if these varying substrate types lead to the production of different leachates, and if there was a resulting variability in the algal community composition. Vernal mesocosms were constructed and lined with one of the four substrate categories listed above. These mesocosms were inoculated with an algal cocktail consisting of field-collected samples from a wide spectrum of community types. Controls consisted of mesocosms with and without algae, but no substrate added. The algal community composition and environmental parameters were tracked over eight weeks to examine differences based on leachate composition. Aliquots were sampled bi-weekly. After 56 days, all conditions except P had significantly greater ($p<0.05$) algal biomass than the control. Further, M, F, and OF mesocosms all had significantly ($p<0.05$) greater biomass than P. A total of 81 algal taxa were identified. Chlorophytes were most abundant and diverse (41 taxa), followed by Cyanobacteria (20), Bacillariophytes (10), Euglenophytes (11), Chrysophytes (3), Cryptophytes (2) and Dinophytes (1).

10:00 GENETIC VARIATION AMONG INDIVIDUALS OF *BATRACHOSPERMUM HELMENTOSUM* (RHODOPHYTA) WITHIN AND AMONG STREAM REACHES THROUGHOUT NORTH AMERICA. Melissa M. Hall & Morgan L. Vis, Ohio University, Dept. of Environmental & Plant Biology, Athens OH 45701. mh957292@ohio.edu

A relatively new molecular marker technique, inter-simple sequence repeats (ISSR), was used to assess the genetic variation of the freshwater red alga *Batrachospermum helmentosum* within a stream reach in Southeastern Ohio and among streams throughout North America. For the intra-stream reach study, 58 individuals were collected from an approximately 200m stream length. Individuals appeared to be congregated into three distinct areas, with no plants between areas. Using three primers, 100 polymorphic bands were scored. Although it was hypothesized that genetic variation would reflect geographic distance, the results showed six distinct genetic groupings, some of which consisted of geographically separated individuals. Overall, genetic diversity was greater among individuals than between geographic and genetic groups. To assess genetic variation among stream reaches, ten streams (3 from OH and one each from MI, IN, TN, LA, MA, RI and CT) were sampled throughout the alga's known distribution in North America. Approximately 20 individuals were collected per stream for ISSR analysis. Five primers were used to examine variation among all individuals. Sequence data from these populations show TN as basal to the other populations, with MI being closely related and the other populations having little genetic variation among them.

10:15 A SURVEY OF CLIFF AND CAVE ALGAE FROM SOUTHEASTERN OHIO. Dale A. Casamatta, Robert G. Verb, and Morgan L. Vis. Ohio University, Dept. of Environmental and Plant Biology, Athens OH 45701. dc274389@ohio.edu

Due to harsh environmental conditions, cliff walls and caves tend to have depauparate vascular plant floras. However, the rapid generation time, resistance to desiccation, and low light requirements of algae and cyanobacteria make them common components of caves and cliff walls. These sites are rarely studied and the taxa common at such sites remain mostly unknown. One region with many potential habitats is the Hocking Hills vicinity, where cliffs and caves are comprised of Black Hand Sandstone. To document the algal flora of some of these habitats, ten cliffs and caves were sampled in this study over a three month period in the spring of 1999. A total of 60 algal taxa were recorded, exclusive of Bacillariophytes. The flora was dominated by Cyanobacteria (43), with Chlorophytes (12), Euglenophytes (4), and Xanthophytes (1) comprising the remainder of observed taxa. The majority of cyanobacterial taxa were Chroococcalian forms that were collected at nine of the ten sites. Four sites had extensive growths of *Nostoc* balls. In addition, 15 non-nitrogen fixing filamentous forms were observed, but these tended to be rare. Chlorophytes and Euglenophytes were most abundant and diverse during March, while the cyanobacteria tended to be more common in April and May. Bacillariophytes were rare, although two sites had thick blooms of the characteristic chain-forming diatom *Orthoseira roeseana*, often restricted to cliff walls. Mesic sites tended to have a greater diversity of taxa than xeric ones, and shaded sites more than open sites.

10:30 FRESHWATER DINOFLAGELLATES OF BELIZE, C.A. Susan Carty, Heidelberg College, Dept of Biology, Tiffin OH 44883. scarty@heidelberg.edu

Freshwater dinoflagellates have not previously been reported from Belize although there has been extensive work with marine dinoflagellates and some work with other freshwater groups. Freshwater dinoflagellates are more frequently found in standing water and none have been found in the several streams and rivers sampled since 1990. The goal of this trip was to examine water samples from small ponds within hours of collection to improve the chance of seeing swimming dinoflagellates. A plankton net was used and whole water samples were also collected. A small brown water pond on a peninsula and 30m from the Caribbean yielded a bloom of *Thompsodinium intermedium*. On the mainland, "Crocodile pond" and "Lily pond" had dinoflagellates including *Peridinium centenniale*, a species of *Katodinium*, and a *Peridinium* in the Umbonatum Group. This is the fifth report of *Thompsodinium* in the world.

10:45 EDGE VERSUS MIDDLE ZOOPLANKTON COMMUNITIES IN A QUARRY SYSTEM. Kristen K. Eppley (Dr. Ken Krieger), Heidelberg College, 310 E. Market St., Tiffin OH 44883. keppley@mail.heidelberg.edu

Avoidance of the littoral zone by lake zooplankton has been observed by some authors. Reasons used to explain this observation include wind patterns, optical versus geotactic orientation, and the greater refuge offered by deep water. This project looks at a filled limestone quarry to see if this phenomenon also exists in quarry limnological settings. White Star Quarry, located in Gibsonburg, OH, was sampled for this experiment. Two sites along the shore were compared to two sites near the middle. Discrete samples from a depth of 1m were taken using a horizontal sampler. The water was poured through a plankton net with a 64?m mesh size. The zooplankton were collected in the attached 140mL bottle and preserved with 5%formaldehyde. These are being analyzed to species using a Ward's plankton counting wheel, a dissecting microscope and a compound microscope. Readings of temperature, dissolved oxygen, pH, conductivity, and turbidity were also taken. It is hypothesized that edge avoidance will not be evident due to the steep banks of the quarry system. This causes the system to lack a broad littoral shelf, changes the optical/geotactic orientation factors, and offers deep water at the edge as well as in the middle of the system. In a sample taken during a preliminary procedure, zooplankton found were *Bosmina sp.*, Calanoida, Cyclopoida, *Keratella sp.*, nauplii, and *Polyarthra sp.*

Aquatic Biology II
02:00PM Saturday, April 1, 2000
Meyer Hall Room 113
Robert T. Heath - Presiding

2:00 HABITAT USE AND DISTRIBUTION OF *CORDULEGASTER ERRONEA* (ODONATA: CORDULEGASTRIDAE) IN OHIO. Robert C. Glotzhober, Ohio Historical Society, 1982 Velma Ave, Columbus OH 43211-2497. bglotzhober@ohiohistory.org

The purpose of this project was to determine the status and distribution of the dragonfly *Cordulegaster erronea* Hagen in Ohio. Between its 1931 discovery in Ohio and 1983, only seven specimens were collected. All of these were from 2 locations in Hocking and Fairfield Counties that are less than 4 km apart. The author and Dan Riggs searched unsuccessfully for two seasons before collecting additional specimens in 1996. Our collecting utilized standard aerial nets and a newly-modified version of the Townes malaise trap for live capture, mark, recapture studies. This dragonfly has narrow habitat requirements. It requires first order streams that are spring fed and that maintain continuous flow. These streams may be less than 30 cm wide and only a few cm deep. The dragonfly also prefers or requires streams in heavily forested areas with dense shade. With conservative collecting of voucher specimens we now have more than 50 specimens in collections. The majority of these are from the Hocking Hills region, but we also have found populations in five other counties, with air distances from the Hocking Hills sites of up to 139 km. The new counties include Adams, Ashland, Belmont, Licking, and Richland. *C. erronea* has very narrow habitat requirements that are atypical for other Odonata and this has led to the perceived rarity. While the habitat itself is uncommon, *C. erronea* is often abundant in restricted areas where its habitat is found.

2:15 A SURVEY OF UNIONID MUSSEL SPECIES OF THE CUYAHOGA RIVER'S WEST BRANCH, Geauga CO., OHIO. Martin K. Huehner, Hiram College, Biology Dept., Hiram OH 44234. huehnermk@hiram.edu

In August of 1999 a mussel survey was conducted on the West Branch of the Cuyahoga beginning at Lake Aquilla and ending at the confluence of the West Branch with the main stem of the Cuyahoga. The entire length of the stream was floated by canoe and each of 18 survey sites were identified with a Garmin 40 GPS unit, and also recorded on a USGS 7.5 minute topographic map. Mussel collection methods were determined by the physical conditions encountered at each site, but usually consisted of churning through the bottom sediment with bare hands. In a few instances water clarity was adequate enough to employ a visual search by snorkeling. A total of 1008 living mussels comprising 9 different species previously known to occur in the main stem of the Cuyahoga were found. Species present were: Cylindrical Papershell, *Anodontoides ferussacianus* (Lea, 1834); Giant Floater, *Anodonta grandis* (Say, 1829); Fatmucket, *Lampsilis radiata luteola* (Lamarck, 1819); White Heelsplitter, *Lasmigona complanata complanata* (Barnes, 1823); Creek Heelsplitter, *Lasmigona compressa* (Lea, 1829); Fluted-shell, *Lasmigona costata* (Rafinesque, 1820); the State Endangered Eastern Pondmussel, *Ligumia nasuta* (Say, 1817); Squawfoot, *Strophitus undulatus undulatus* (Say, 1817); and Paper Pondshell, *Utterbackia imbecillis*

(Say, 1829). Living specimens of Eastern Pondshell mussels were found at 10 of the 18 survey sites and comprised 3.87% of the total sample of 1008 living mussels found. New locality records for living Eastern Pondshell, Creek Heelsplitter, Squawfoot, Fluted-Shell, Paper Pondshell, and Cylindrical Papershell were also established. Supported by ODNR Division of Natural Areas and Preserves.

2:30 THE EVOLUTIOIN OF SIMULTANEOUS HERMAPHRODITISM IN THE FRESHWATER MUSSEL GENUS *TOXOLASMA* (BIVALVIA: UNIONIDAE). Angela M. Fetty (Walter R. Hoeh), Kent State University, Dept. of Biological Sciences, Kent OH 44242. Afetty7013@aol.com

Taxa that are reproductively variable have provided biologists with the ability to test mechanisms of evolutionary change. North American freshwater mussels, a primarily dioecious taxon, are an exceptionally useful study group for investigating mating system transitions (e.g., from dioecy to simultaneous hermaphroditism [SH]). Studies of unionid genera consisting of both dioecious and hermaphroditic species offer significant opportunities for increased comprehension of the ecological, genetic, historical, and morphological factors involved in the origin and maintenance of SH. The freshwater mussel genus *Toxolasma* currently contains eight recognized species: *T. corvunculus, T. cylindrellus, T. lividus, T. mearnsi, T. parvus, T. paulus, T. pullus,* and *T. texasensis* (*T. parvus* is the only hermaphroditic species). Species delineation and interspecific relationships within *Toxolasma*, currently based on morphological data sets, are questionable and have hindered the examination of mating system transitions in this genus. The goal of this project is to use phylogenetic analysis of DNA sequence data (from the cytochrome *c* oxidase subunit I [COI] gene) to (1) estimate the evolutionary relationships among multiple populations representing the species within *Toxolasma* and (2) use this estimate to infer the minimum number of mating system transitions that occurred within *Toxolasma*. The estimation of the phylogenetic relationships among the species within *Toxolasma* is a necessary first step toward gaining an understanding of the events that led to the origin of SH in this genus. To date we have extracted total DNA, PCR amplified a portion of the COI gene, gel purified the PCR products, and ran sequencing reactions for both strands of the PCR products. We have sequence from 42 individuals, representing 42 populations.

2:45 INFLUENCE OF ZEBRA MUSSELS, *DREISSENA POLYMORPHA*, ON PHYTOPLANKTON PHOTOSYNTHESIS IN LAKE ERIE. Robert T. Heath, X. Gao, H. Wang, and V. Mattson, Kent State University, Dept. Biological Sciences, Kent OH 44242. rheath@kent.edu

Although much attention has been given to investigation of population- and community-level effects of zebra mussels (ZM, *Dreissena polymorpha*), relatively little attention has been given to ecosystem-level effects of this non-indigenous mollusc. Here we report the possible effects of these molluscs on photosynthetic capabilities dependent on the physiological responses of phytoplankton in the western basin of Lake Erie. Phytoplankton were collected in 8L carboys from the 1 m stratum 9 km west of Rattlesnake Is. and 2 km north of Niagra Reef, a region with a silty sediment and relatively unpopulated by ZM. Fifteen ZM (1.3 to 1.7 cm in length) collected from rocks near Green Is. were washed, and placed in some carboys (exptl.) and not in others (control); carboys were incubated under laboratory conditions approximating ambient light and temperature. After 24 hours, photosynthetic parameters a, the photosynthetic potential, P_{opt}, the optimum photosynthesis per µg chlorophyll, and b, the photoinhibition coefficient for the phytoplankton in the carboys was determined in a "photosynthetron" that controls temperature at ambient T and varies light intensity of photosynthetically active radiation from 0 to 700 µE sec^{-1} m^{-2}. We found that in the presence of ZM, P_{opt} and α significantly declined, while b increased. This indicates that the presence of ZM may decrease the photosynthetic responses of phytoplankton communities they encounter not only by decreasing the number of phytoplankton but also by altering their physiology. This study was supported by Lake Erie Protection Fund Grant Nos. 97-18 and 98-09.

3:00 SELECTIVITY OF FISH SIZE AND SPECIES COMPOSITION FOR THREE TRAP NET DESIGNS. Daniel E. Shoup, Robert E. Carlson and Robert T. Heath, Kent State University, Dept. of Biological Sciences, Kent OH 44242. dshoup@kent.edu

Trap nets of varying design are commonly used to assess fish populations, but the effect of design on selectivity is not well known. This study compared both the size distribution and species composition of fish caught by trap nets with dimensions differing only in mesh size (0.6 cm delta mesh, 1.3 cm or 2.5 cm square mesh for small, medium, and large nets respectively) and throat size (3.8, 7.6 or 12.7 cm square respectively). Two nets of each mesh/throat size shared a 9 x 1.2m lead. Each net in the pair also had one 3 x 1.2 m wing. Nets were set on the bottom along the 2 m contour in Sandy Lake, Portage Co., Ohio. Nets were sampled 25 times between July 4, 1999 and August 20, 1999. All fish caught were identified and enumerated. On 14 dates, the total lengths were also recorded. There were significant differences in the minimum, mean, and maximum size of fish caught by the different mesh/throat sized trap nets. Large mesh/throat nets had significantly larger total catch per unit effort (CPUE) than small mesh/throat nets. Some species-specific CPUE's also differed between some net sizes. We conclude that data from trap nets with different mesh and throat sizes should not be directly compared with each other, and that multiple net mesh/throat sizes should be utilized when a more complete picture of fish size and abundance is desired. This research was supported in part by Sigma Xi, The International Research Society.

3:30 GENETIC STUDIES OF POPULATION STRUCTURE IN THE LAKE STURGEON OF THE GREAT LAKES. Tara Rose, Ted M. Cavender, Brian Mark and Paul A. Fuerst, Ohio State University, Dept. of Evolution, Ecology and Organismal Biology, Columbus OH 43210. Rose.256@osu.edu

Information about the genetic population structure of the lake sturgeon, *Acipenser fulvescens*, in the Great Lakes, is critical to adequate management of this locally endangered fish. Questions concerning the degree of population differentiation, and the similarity of populations are relevant in making decisions concerning possible restocking or supplemental stocking of populations. Genetic differences between localities within the lake sturgeon population have been examined using RAPD (Randomly Amplified Polymorphic DNA) analysis and microsatellite locus comparison. A set of fish representing several localities throughout the Great Lakes has been analyzed. These localities include the Wolf River and Menominee River from Wisconsin, the Sturgeon River and the St. Clair River and Lake Erie. Population distances based on allele sharing and allele frequency were determined and population relationships analyzed using UPGMA cladograms. The RAPD studies show substantial differences between localities, and an East-West component of overall differentiation. The analysis of these data by cladistic methods shows that genotypes are shared between some populations. An analysis of the same localities using microsatellite DNA shows a similar clustering of populations. The data should be expanded with additional populations and more loci to confirm the preliminary findings. The results suggest that transplantation of stock must be undertaken with care. (We thank the Wisconsin, Michigan and Ohio DNRs for assistance in collecting material and the USFWS, Ohio Sea Grant and the National Science Foundation for partial support of the work reported here).

3:45 MICROSATELLITE ANALYSIS OF FORMALIN TREATED LAKE ERIE STURGEON TO DETERMINE THE GENETIC VARIABILITY FOLLOWING A POPULATION CRASH. Julie L. Maybruck, and Paul Fuerst, Ohio State University, Dept of Molecular Genetics, Columbus OH 43210. Maybruck.2@osu.edu

Populations of the Lake sturgeon, *Acipenser fulvescens*, suffered a severe reduction in numbers when the value of sturgeon flesh and caviar was realized in 1860. By the end of the 19th century, the population in Lake Erie alone was reduced by 80%. A decline of this magnitude suggests that a population bottleneck may have occurred. To assess this possibility, a temporal genetic study examining the genetic variation of Lake Erie sturgeon is being conducted. Formalin treated specimens collected throughout the 20th century were obtained from The Ohio State University Museum of Biodiversity. These samples represent part of a larger study to determine if a population bottleneck has occurred. Difficulties in obtaining DNA from formalin have been reported. For example, Giorgi et al. (1994) found that formalin fixation caused DNA sequence changes. These results were confirmed by a study conducted in our lab, indicating that sequence comparisons are unreliable. However, no insertions or deletion events were observed in the mitochondrial analyses conducted in our lab nor were they reported by Giorgi et al. in their study of formalin treated nuclear DNA. Since microsatellite allele difference occur by changes in size but not in sequence, microsatellite DNA analysis of formalin fixed material was investigated. It was first necessary to determine the reliability of the microsatellite data from formalin treated specimens. A comparative study of microsatellite data between matched ethanol fixed and formalin treated samples from the same individuals was conducted. The banding patterns of ethanol and formalin treated samples from the same individual were found to be the same. Allele sizes were not changed. Microsatellite analysis appears to be a reliable and more appropriate technique for the analysis of the formalin treated specimens. Results using this method will be presented. (Supported by funds from the Ohio Sea Grant College Program).

4:00 EFFECTS OF PREY AVAILABILITY ON LARVAL GIZZARD SHAD (*DOROSOMA CEPEDIANUM*) PREY SELECTIVITY. David W. Paul, Maria J. Gonzalez and Amina I. Pollard. Wright State University, Dept. of Biological Sciences, 3640 Colonel Glenn Hwy, Dayton OH 45435-0001. dpaul@ehstech.com

The objective of this study was to compare prey selectivity by larval gizzard shad in a hypereutrophic reservoir (Acton Lake, Ohio) between years with different zooplankton composition (1996 and 1997). Zooplankton abundance was higher in 1996 than 1997. Rotifers dominated the zooplankton community (48.28% in 1996 and 92.31% in 1997) when larval gizzard shad were present in the lake. The proportion of cladocerans and small copepods was higher in 1996 (31.6%) than 1997 (6.7%). Mean density of larval gizzard shad was lower in 1996 (2.2 ind/m^3, max 10.4 ind/ m^3) than in 1997 (7.4 ind/m^3, max 35.6 ind/m^3). We calculated Chesson's Prey Selectivity Index on three larval fish sizes (< 10.5 mm TL, 10.6-15.0 mm TL and >15.1 mm TL). In 1996, larval gizzard shad <10.5 mm TL positively selected for nauplii, *Asplanchna sp., Polyarthra sp.* and *Synchaeta sp.* The medium size-class 10.6-15.0 mmTL selected cyclopoids, nauplii and *Asplanchna sp.* Larvae greater than 15.1 mmTL positively selected for *Daphnia parvula*, cyclopoids, nauplii and *Asplanchna sp.* In 1997 larvae <10.5 mm TL positively selected for cyclopoids, *Asplanchna sp , Brachionus angularis, Polyarthra sp.*, and *Synchaeta sp.* The medium size class selected for *Asplanchna sp., Polyarthra sp.*, and *Synchaeta sp.* Large larvae selected strongly for *Brachionus angularis* and *Asplanchna sp.* Our results suggest that rotifers, which are commonly excluded from studies of feeding preference, may be important food sources of gizzard shad throughout larval life stages, in particular, when the availability of cladocerans and copepods is low.

4:15 PRELIMINARY FINDINGS OF NONTARGET FISH DISPERSAL VIA LIVE BAIT SHIPMENTS IN OHIO. Fred L. Snyder, Ohio Sea Grant Extension, Camp Perry, Bldg. 3, Rm. 12, Port Clinton OH 43452. snyder.8@osu.edu

Shipments of live fishing bait, particularly minnows, are widely suspected of transporting nontarget fish species into Ohio, raising the possibility of introducing these species into local waters. A study begun in 1998 purchased minnow samples from retail outlets along Lake Erie and in the Miami, Scioto, Muskingum and Ohio River valleys. Outlets were selected from a license list to maximize geographic coverage and to sample products from major wholesale distributors. Seventeen percent of samples collected in 1998 contained nontarget fishes, excluding mixtures of advertised minnow species that were considered to have originated from cross-tank mixing within the stores. No designated aquatic nuisance species were found in the samples, although alewife (*Alosa pseudoharengus*) were observed in one tank. All nontarget fishes were species considered native to Ohio. Thirty-nine percent of samples collected in 1999 contained nontarget fish species. Particular concern arose when four of ten outlets along Lake Erie visited in 1999 had tanks containing sometimes substantial numbers of western banded killifish (*Fundulus diaphanus menona*), an Ohio endangered species. With this finding, the Ohio Department of Natural Resources ordered 183 bait dealers to remove all killifish from their tanks. ODNR is reviewing potential new live bait regulations to minimize the movement of nontarget fish species into Ohio.

4:30 LAKE VICTORIA REGION: LARGE LAKES AND THEIR SURROUNDING MINOR WATER BODIES AS A NATURAL LABORATORY FOR ADAPTIVE ECOLOGY, SPECIATION AND EVOLUTION OF FISH SPECIES. Paul A. Fuerst, Les Kaufman and Wilson W Mwanja, Ohio State University, Dept. of Molecular Genetics, Columbus OH 43210. fuerst.1@osu.edu

The Lake Victoria Region (LVR) is a unique zoogeographical area. The LVR now comprises five large lakes, Victoria, Kyoga, Edward, George and Kivu, each containing a repeated set of fish faunal groups that share common origins. Evolution has repeated itself numerous times - affected by evolutionary parallelism and dispersal. Historically the LVR was more expansive, with adjoining east-west rivers, breaking up following tectonic and volcanic activity. The lakes, though zoogeographically similar, are geologically, hydrologically and limnologically different. A variety of small Asatellite@ lakes exist around larger LVR lakes. Exploratory surveys reveal significant portions of the cichlid fauna considered extinct in large lakes may survive in satellite lakes. Some satellite lakes, such as the Nabugabo lakes, retain a small number of species found nowhere else. Other satellite lakes, such as the Kyoga lakes in central Uganda, have a wide variety of species including undescribed species that seem to be sister species to extinct taxa from larger lakes. Microsatellite DNA markers which are shown to differentiate populations and species, are being used to investigate phylogenetic and macroevolutionary questions in the LVR haplochromine species. Understanding the evolutionary and hydrological processes shaping the LVR system depends on determining whether the species in small water bodies have recent origins or reflect longer historical changes. Conservation of aquatic biodiversity requires knowledge about the species and relationships among extant evolutionary and ecological groups. Molecular information will directly impact decisions about fisheries management and conservation practices in the LVR especially for the closely related species found in this geologically vast area.

4:45 THE INFLUENCE OF DIET ON THE GROWTH OF ANURAN LARVAE (*RANA PIPIENS*). Alex Collier, Dale A. Casamatta, and Lowell P. Orr, Kent State University, Dept. of Biological Sciences, Kent OH 44240. acollier@kent.edu

Anuran larvae play an important role in freshwater systems. They filter phytoplankton and other suspended particles from the water column and use their keratinized beaks and denticles to scrape, bite and ingest epiphytic algae and other vegetation. We compared the ability of *Rana pipiens* larvae to ingest four species of green algae collected from area wetlands. Sixty tadpoles were placed in each of the following monocultures: *Hydrodictyon reticulatum*, *Ulothrix aequalis*, *Zygnema pectinatum*, and *Spirogyra crassa*. Treatment tanks containing larvae, algae and 8 L of filtered (1.0mm pore) rainwater were equipped with aerators and housed in a greenhouse during the 30 day investigation. We collected ten larvae at five-day intervals and recorded their size, weight and developmental stage. The feeding rate for each culture was measured directly as the rate at which particulate matter entered the gut. Ash-free dry weight was used to estimate the total biomass ingested within a 4h interval. Data were analyzed using a one-way ANOVA ($p = 0.05$) and Student-Newman-Keuls post hoc test when appropriate. Tadpoles fed *Zygnema pectinatum* grew more slowly than larvae from other treatment groups. Conversely, larvae collected from *Spirogyra crassa* tanks were on average significantly longer and heavier than tadpoles from other treatment groups. Our data suggest that there are nutritional differences between the four species of filamentous green algae selected for this experiment.

NOTES

OFFICIAL ANNOUNCEMENT

Saturday, April 1, 2000, 5:15 P.M.
Ohio Northern University, Ada, Ohio
Meyer Hall Room 104

ANNUAL BUSINESS MEETING
FOR MEMBERS ONLY:

There shall be an Annual Business Meeting for the membership of the Academy during the Annual Meeting. The business session shall be conducted in accordance with the most recently published edition of "*Robert's Rules of Order*". The order of procedure shall be as follows:

A. A Call to Order by the President.
B. A summary of the Minutes of the previous meeting shall be read by the Secretary.
C. Presentation of the report of the tellers of the election of officers and other positions.
D. Voting on any proposed amendments to the *Constitution* or *By-Laws*.
E. Business from the floor.
F. Adjournment.